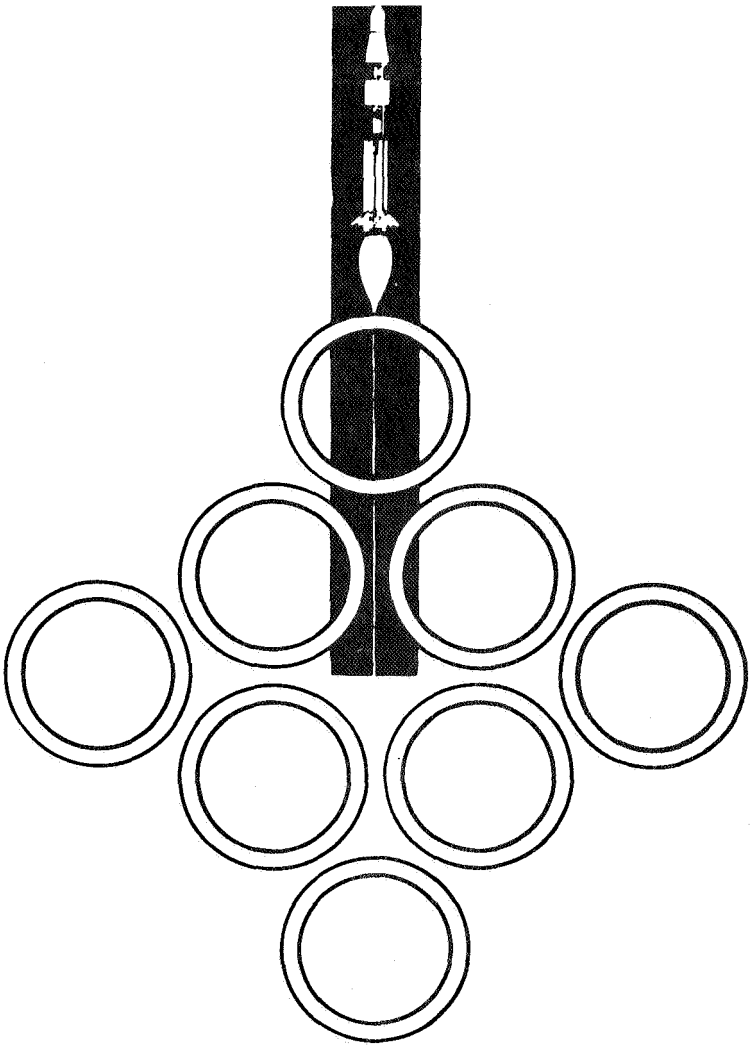

ENGINEERING DEPARTMENT

TECHNICAL REPORT

TR-RE-CCSD-FO-1115-3

July 6, 1967

SATURN IB PROGRAM

TEST REPORT
FOR

ANGLE VALVE, 3/8-INCH

James, Pond, and Clark Inc., Part Number BR949T1-6BB(T9)

NASA Drawing Number 75M09618 PAV-2

SPACE DIVISION CHRYSLER CORPORATION

TEST REPORT

FOR

ANGLE VALVE, 3/8-INCH

James, Pond and Clark, Inc., Part Number BR949T1-6BB(T9)

NASA Drawing Number 75M09618 PAV-2

ABSTRACT

This report presents the results of tests performed on one specimen of Angle Valve 75M09618 PAV-2. The following tests were performed:

1. Receiving Inspection
2. Proof Pressure
3. Functional
4. Flow
5. Surge
6. Low Temperature
7. High Temperature
8. Cycle
9. Sand and Dust
10. Salt Fog
11. Burst

The specimen's performance was in accordance with the specification requirements of NASA drawing number 75M09618 PAV-2 except during the cycle test. After 143 cycles the torque required to operate the valve exceeded the 10 foot-pounds seating and the 5 foot-pounds running torque. Disassembly of the valve revealed damaged threads on the valve stem and failure of the packing gland. The valve was sent to the vendor for reworking and after return to CCSD, the specimen was retested. Results of the second cycle test were satisfactory.

TR-RE-CCSD-FO-1115-3

TEST REPORT

FOR

ANGLE VALVE, 3/8-INCH

James, Pond and Clark, Inc., Part Number BR949T1-6BB(T9)

NASA Drawing Number 75M09618 PAV-2

July 6, 1967

CHRYSLER CORPORATION SPACE DIVISION - NEW ORLEANS, LOUISIANA

FOREWORD

The tests reported herein were conducted for the John F. Kennedy Space Center by Chrysler Corporation Space Division (CCSD), New Orleans, Louisiana. This document was prepared by CCSD under Contract NAS 8-4016, Part VII, CWO 271620.

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Angle Valve, 3/8-Inch, 75M09618 PAV-2

CHECK SHEET

FOR
ANGLE VALVE, 3/8-INCH

MANUFACTURER: James, Pond and Clark, Inc.
MANUFACTURER'S PART NUMBER: BR949T1-6BB(T9)
NASA PART NUMBER: 75M09618 PAV-2
TESTING AGENCY: Chrysler Corporation Space Division, New Orleans, La.
AUTHORIZING AGENCY: NASA KSC

I. FUNCTIONAL REQUIREMENTS

A.	OPERATING MEDIUM:	Nitrogen or helium
B.	OPERATING PRESSURE:	6000 psig
C.	LEAKAGE:	Bubble tight below 6000 psig
D.	TORQUE:	Max. breakaway: '10 ft-lb with 6000 psig Max. running: 5 ft-lb Max. seating: 10 ft-lb against 6000 psig
E.	PROF PRESSURE:	9000 psig
F.	FLOW Cv:	Determine
G.	BURST PRESSURE:	24,000 psig, minimum

II. CONSTRUCTION

A.	BODY MATIBIAL:	316 stainless steel, passivated per 5.4.1 of MIL-STD-171
B.	SEAT MATERIAL:	KEL-F or 316 stainless steel
C.	BACK-UP RING MATERIAL:	KEL-F
D.	CONTROL KNOB MATERIAL:	Aluminum
E.	PACKING MATERIAL:	Teflon
F.	INLET PORT:	3/8 inch
G.	SECTIONAL DIMENSIONS :	Drawing 75M09618 PAV-2

III. ENVIRONMENTAL CHARACTERISTICS-MANUFACTURER'S SPECIFICATIONS

OPERATING TEMPERATURE: +5 to 160°F

IV. LOCATION AND USE

Pneumatics system of the ground support equipment, Launch Complex 34.

TEST SUMMARY

ANGLE VALVE, 3/8-INCH

75M09618 PAV-2

Environment	Units	Operational Boundary	Test Objective	Test Results	Remarks
Receiving Inspection	1	NASA Drawing Number 75M-09618 PAV-2	Visual and dimensional examination for compliance	Satisfactory	No visual deviations from the specification or good workmanship
Proof Pressure	1	9,000. psig for five minutes	Check for leakage or distortion	Satisfactory	No leakage or distortion
Functional Test	1	Leakage: Bubble tight at 6000 psig	Check for leakage and establish opening, closing and running torque values	Satisfactory	No leakage
Flow Test	1	Cv to be determined	Determine Cv for the valve	Satisfactory	Average Cv of 0.425
Surge Test	1	0 to 6000 psig for 20 cycles	Determine if specimen's operation is impaired by surge	Satisfactory	No leakage or apparent distortion
Low Temperature Test	1	+5 (+0,-4)°F	Determine if the environments cause degradation or deformation	Satisfactory	No leakage or apparent distortion
High Temperature Test	1	+160 (+4,-0)°F		Satisfactory	
Cycle Test	1	Operating the specimen for 1000 complete cycles with 6000 psig on inlet to valve	Determine if the environment causes degradation or deformation due to accumulative wear	Uwsatisfactory Excessive leakage after 143 cycles	Valve stem threads and packing gland were damaged. Valve returned to vendor for reworking
Sand and Dust Test	1	2 hours at 77°F 2 hours at 160°F	Determine if sand particles can cause malfunction	Satisfactory	Valve did not malfunction
Salt Spray	1	240 (±2) hours	Determine if specimen operation is impaired by salt environment	Satisfactory	Valve functioned satisfactorily
Burst	1	24,000 psig for 5 minutes minimum	Check for structural damage and leakage	Satisfactory	Valve did not rupture at 24,000 psig

SECTION I

INTRODUCTION

1.1 SCOPE

1.1.1 This report describes the testing of the 3/8-inch, manually operated Angle Valve 75M09618 PAV-2. Tests included were those necessary to determine whether the valve will satisfy the operational and environmental requirements of the John F. Kennedy Space Center. A summary of the test results is presented on page ix.

1.1.2 One specimen was tested.

1.2 ITEM DESCRIPTION

1.2.1 Angle Valve 75M09618 PAV-2 has a 3/8-inch nominal size inlet port. It has a design perating pressure of 6000 psig and is rated for use with nitrogen and helium.

1.3 APPLICABLE DOCUMENTS

The following documents contain the test requirements for Angle Valve 75M09618 PAV-2.

a. KSC-STD-164(D), Standard Environmental Test Methods for Ground Support Equipment Installations at Cape Kennedy.

b. Component Specification 75M09618 PAV-2

c. Cleanliness Standard A1OM10671

d. Test Plan CCSD-FO-1115-1F

e. Technical Procedure TP-RE-CCSD-FO-1115-2F

SECTION II

RECEIVING INSPECTION

2.1 REQUIREMENTS

The specimen shall be visually and dimensionally inspected for conformance with NASA Specification 75M09618 PAV-2 prior to the start of the tests. The specimen shall also be inspected for poor workmanship and manufacturing defects.

2.2 TEST PROCEDURE

The specimen was checked to determine compliance with NASA Specification 75M09618 PAV-2 and applicable vendor drawings to the extent possible without disassembling the test specimen. At the same time the test specimen was also inspected for poor workmanship and manufacturing defects.

2.3 TEST RESULTS

The specimen complied with drawing 75M09618 PAV-2. No evidence of poor workmanship or manufacturing defects was observed.

2.4 TEST DATA

The data presented in tables 2-1 and 2-2 were recorded during the inspection.

Table 2-1. Receiving Inspection Test Data

Item	Specified	Actual
Physical description	Angle Valve, 3/8-inch	Angle Valve, 3/8-inch
Body material	Stainless steel	Stainless steel
Seat material	KEL-F	KEL-F
Handwheel material	Aluminum	Aluminum
Handwheel diameter	2.18 in.	2.15 in.
Overall length (open)	4.0 in. (max.)	3.75 in.
Overall length (closed)	3.52 in. (max.)	3.49 in.
Body housing dimensions	1.0 x 1.0 x 1.34 in.	1.0 x 1.0 x 1.32 in.
Inlet and outlet I.D.	0.5625 in.	0.562 in.

Table 2-2. Receiving Inspection Test Equipment List

Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Cal. Date
1	Steel Scale	Browne & Sharpe	300	NASA 101-1013	7-23-64
2	1-in. micrometer	Craftsman	N/A	NASA 106-1137-P	4-20-67
3	4-in. inside caliper	Union Tool	N/A	N/A	

SECTION III

PROOF PRESSURE TEST

3.1 TEST REQUIREMENTS

3.1.1 The test specimen shall be subjected to a proof pressure of 9000 psig.

3.1.2 The pressure shall be simultaneously applied to the inlet and outlet ports, with the valve in the open position, and shall be maintained for 5 minutes.

3.1.3 The specimen shall be inspected for leakage and distortion.

3.2 TEST PROCEDURE

3.2.1 The test specimen was installed in the test setup as shown in figures 3-1 and 3-2 utilizing the equipment listed in table 3-1.

3.2.2 Regulator 21 was adjusted for zero outlet pressure.

3.2.3 The test specimen and hand valves 6, 7, 8, 9, 10 and 11 were opened and the system was filled with water, The fittings at the specimen and gage 3 were loosened to bleed all air from the system. The fittings were then tightened.

3.2.4 Hand valves 6, 8, 9 and 11 were closed.

3.2.5 Hand valve 5 was opened and 3000 psig GN_2 was monitored on gage 4.

3.2.6 Regulator 21 was adjusted until a pressure of 75 psig was indicated on gage 15.

3.2.7 Switch 17 was then closed. Solenoid valve 18 was opened and pump 19 started.

3.2.8 The pump continued to operate until a pressure of 9000 psig was indicated on gage 3. Switch 17 was then opened to stop pumping.

3.2.9 The 9000 psig pressure was maintained for 5 minutes, and the specimen was checked for leakage.

3.2.10 Hand valves 8 and 11 were opened to vent the system, and the specimen was then checked for distortion.

3.3 TEST RESULTS

The specimen did not **leak and there was no evidence of distortion.**

3.4 TEST DATA

The test data are presented in **table 3-2.**

Table 3-1. Proof Pressure and Burst Test Equipment List

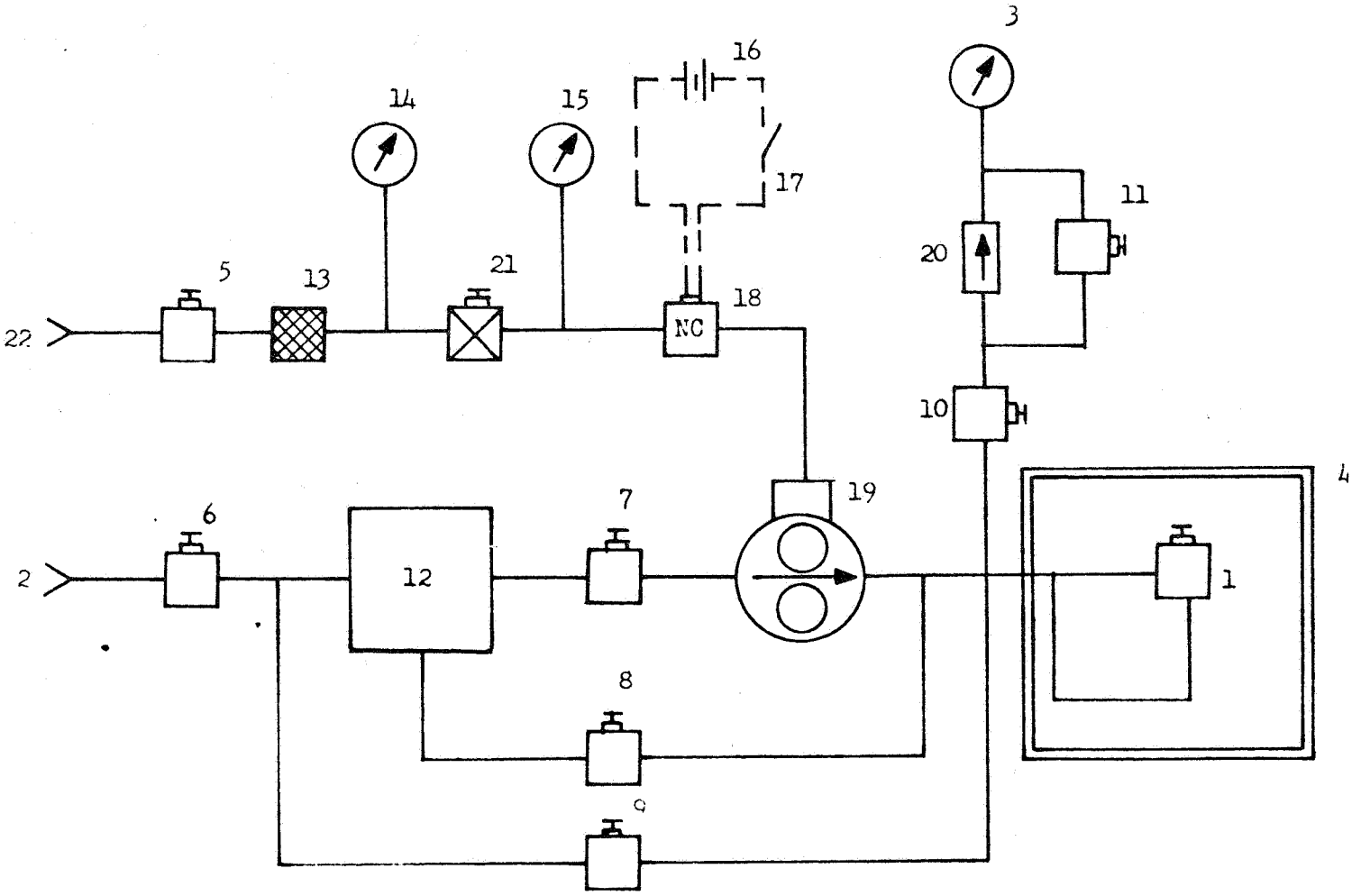
Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Remarks
1	Test Specimen	James, Pond, and Clark, Inc.	BR949T1-6BB(T9)	60100412	Angle Valve 3/8-in.
2	Water Supply	NOPSI	NA	NA	Tap water
3	Hydrostatic Pressure Gage	Astra	NA	D118930A	Range: 0-to 100,000-psig +2.0% FS Cal. date 11/2/66
4	Burst Chamber	CCSD	NA	201344	3 ft x 3 ft x 3ft
5	Hand Valve	Aminco	50011A	NA	1/4-in.
6	Hand Valve	Aminco	50011A	NA	1/4-in.
7	Hand Valve	Aminco	50011A	NA	1/4-in.
8	Hand Valve	Aminco	50011A	NA	1/4-in.
9	Hand Valve	Aminco	50011A	NA	1/4-in.
10	Hand Valve	Aminco	50011A	NA	1/4-in.
11	Hand Valve	Aminco	50011A	NA	1/4-in.
12	Water Reservoir	CCSD	NA	NA	2-gal.
13	Pneumatic Filter	Bendix Corp.	1731260	NA	2-micron
14	Pneumatic Gage	Ashcroft	10575	NA	0-to 5000-psig + 2% FS
15	Pneumatic Gage	USG	8990	NA	0-to 300-psig +2% FS
16	Power Supply	CCSD	NA	NA	28 vdc
17	Switch	Cutler-Hammer	NA	NA	SPST
18	2-Way Solenoid Valve	Marotta Valve Corp.	207803	NA	Normally closed
19	Hydrostatic Pump	Sprague Engineering Corp.	NA	300-16-64	Air operated, maximum pressure 60,000 psig

Table 3-1. Proof Pressure and Burst Test Equipment List (Continued)

Item No.	Item	Manufacturer	Model/ Part No,	Serial No.	Remarks
20	Check Valve	Aminco	44-6305	NA	1/4-in.
21	Regulator	Marotta Valve Corp.	NA	NA	3000-psig inlet 0-to 200-psig outlet
22	Pneumatic Pressure Source	Air Products	NA	NA	3000-psig

Table 3-2. Proof Pressure Test Data

Pressure	9000 psig/5 minutes
Leakage	Zero
Distortion	Zero



Note: All lines 1/4 inch.
Refer to table 3-1 for item identification.
All dash lines represent electrical circuitry.

Figure 3-1. Proof Pressure and Burst Test Schematic

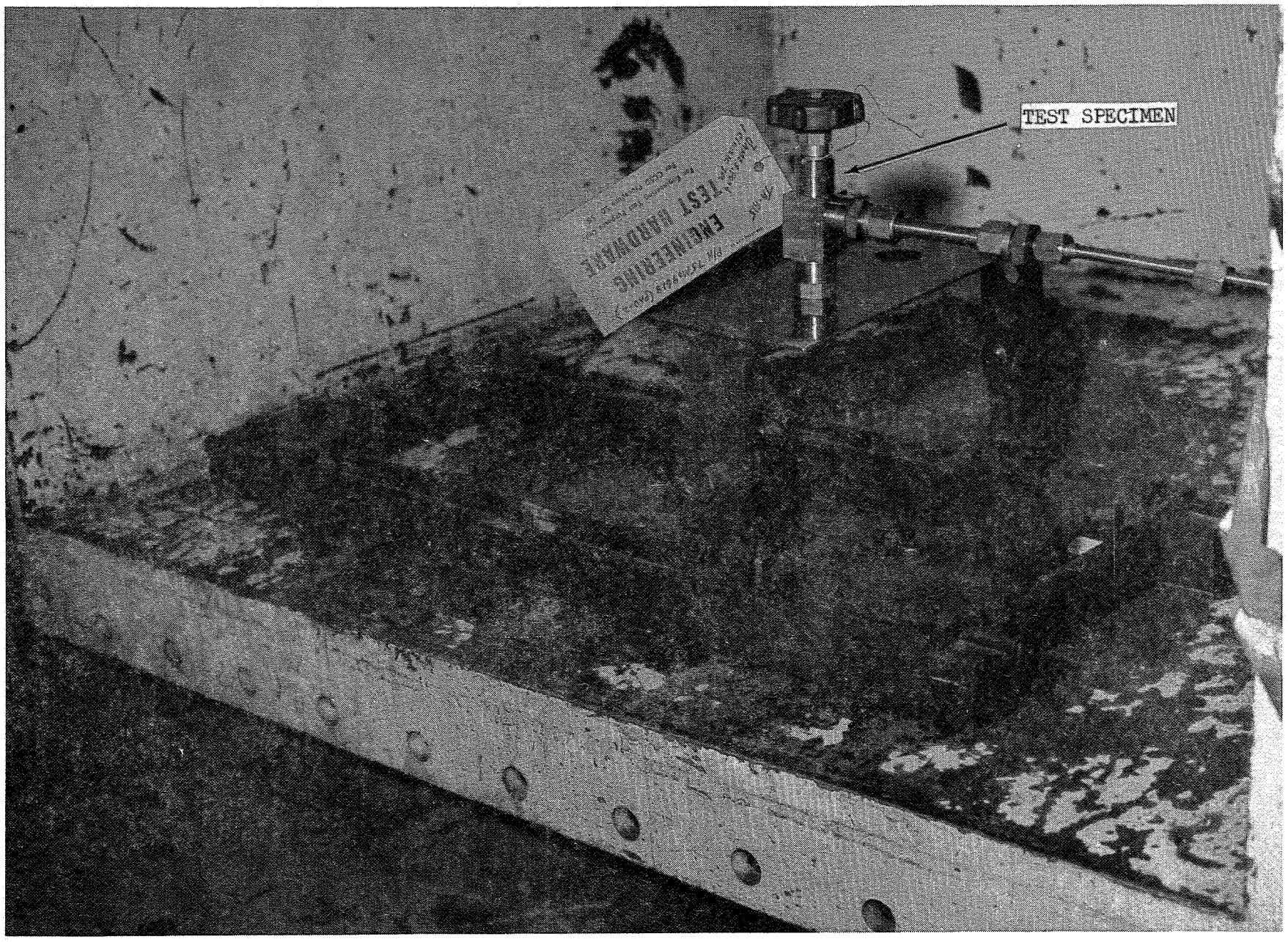


Figure 3-2. Proof Pressure and Burst Test Setup

SECTION IV

FUNCTIONAL TEST

4.1 TEST REQUIREMENTS

4.1.1 The test specimen shall be inspected for leakage with the outlet port of the specimen pressurized to 6000 psig, specimen closed, and the inlet port vented. Leakage shall be recorded.

4.1.2 The test specimen shall be inspected for leakage with the inlet port of the specimen pressurized to 6000 psig, specimen closed, and the outlet port vented. Leakage shall be recorded.

4.1.3 The opening, closing, and normal running torque of the valve shall be determined with the inlet port pressurized to 6000 psig and then relieved to zero psig. Record all data.

4.1.L The procedure described in 4.1.1 and 4.1.2 each shall be repeated once for the initial functional test and performed once for all subsequent functional tests. Procedures described in 4.1.3 shall be performed ten times initially and three times for all subsequent functional tests.

4.2 TEST PROCEDURE

4..2.1 The test setup was assembled as shown in figure 4-1 and 4-2 using the equipment listed in table 4-1 except for thermocouple 17 and thermal chamber 18. All hand valves were closed. Flex hose 20 (port A) was connected to the outlet port of the specimen and flex hose 21 (port B) was connected to the inlet port.

4.2.2 The hand wheel of the test specimen was replaced with torque wrench 13 and the test specimen was closed using the maximum seating torque of 10 inch-pounds.

b.2.3 Regulators 6 and 15 were adjusted for zero outlet pressure.

4.2.4 Hand valve 3 was slowly opened, and gage 5 indicated 7000 psig.

4.2.5 Regulator 6 was adjusted to establish 6000 psig, as indicated on pressure gage 7.

4.2.6 Hand valve 10 was opened to determine the amount of leakage by the displacement of water in graduated cylinder 11.

k.2.7 Regulator 6 was adjusted for zero outlet pressure and hand valve 8 was opened to vent the specimen.

4.2.8 Hand valves 8 and 10 were closed.

4.2.9 Flex hose 20 (port A) was connected to the inlet port of the specimen and flex hose 21 (port B) was connected to the outlet port.

4.2.10 The procedures described in 4.2.5 through 4.2.8 were repeated,

4.2.11 By adjusting regulator 6, the specimen pressure, as indicated on pressure gage 7, was slowly increased to 6000 psig,

4.2.12 The breakaway torque of the specimen was measured by slowly applying the maximum torque required to unseat the specimen.

4.2.13 After the breakaway torque was measured, the specimen was completely opened. The running torque required from breakaway until the specimen fully opened, was measured.

4.2.14 The specimen was closed and the closing running torque was measured.

4.2.15 Hand valve 9 was opened and closed to vent the outlet pressure of the specimen. Hand valve 10 was opened.

4.2.16 The specimen was slowly opened until bubbles appeared in water tank 12.

4.2.17 The specimen was slowly closed and the torque required to stop the bubbles in water tank 12 was measured. This was the closing torque for the specimen at operating pressure.

4.2.18 Regulator 6 and hand valve 10 were closed.

4.2.19 Hand valves 8 and 9 were opened and closed to vent the specimen.

4.2.20 The procedures described in 4.2.12 through 4.2.14 were repeated to determine breakaway and running torque values for the unpressurized specimen.

4.2.21 Flex hose 20 (port A) was disconnected and capped, and flex hose 19 (port C) was connected to the inlet port of the specimen,

4.2.22 Regulator 6 was adjusted to establish 100 psig on pressure gage 7.

4.2.23 Hand valve 14 was opened.

4.2.24 Regulator 15 was slowly adjusted, establishing a 2-psig reading on pressure gage 16.

4.2.25 Hand valve 10 was opened.

4.2.26 The test specimen was slowly opened until bubbles appeared in water tank 12.

4.2.27 The test specimen was slowly closed and the torque required to stop the bubbles was measured. This was the closing torque for the specimen when it was essentially unpressurized.

4.2.28 Regulators 6 and 15 were closed and hand valve 8 was opened to vent the supply pressure.

4.2.29 Hand valves 8, 10 and 14 were closed.

4.2.30 Flex hose 19 (port C) was disconnected and port A of flex hose 20 was uncapped and connected to the inlet of the specimen.

4.2.31 The test specimen was closed using the maximum seating torque of 10 inch-pounds.

4.2.32 The procedures described in 4.2.11 through 4.2.31 were performed ten Limes and the procedures described in 4.2.1 through 4.2.10 were repeated once for the initial functional test.

4.2.33 For all subsequent tests, the procedures described in 4.2.11 through 4.2.30 were performed three times and 4.2.1 through 4.2.10 once.

4.3 TEST RESULTS

The test specimen functioned satisfactorily during the initial functional test.

4.4 TEST DATA

Initial functional test data are presented in table 4-2.

Table 4-1. Functional Test Equipment List

Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Remarks
1	Test Specimen	James, Pond and Clark, Inc.	3R949T1-6BB(T9)	60100412	Angle Valve, 3/8 inch
2	He Source	CCSD	NA	NA	7000-psig
3	Hand Valve	Combination Pump and Valve Co.	380-3	NA	1½-in.
4	Filter	Microporous	4813F-2M	NA	2-micron
5	Pressure Gage	Heise	49479	NASA 95-1852-B	0-to 10,000-psig ±0.2% FS Cal. date 10-15-66
6	Pressure Regulator	Tescom Corp.	26-1002	1002	7000-psig inlet 0-to 7000-psig outlet
7	Pressure Gage	Ashcroft	1057S	NA	0-to 10,000-psig ±0.25% FS Cal. date 11-25-66
8	Hand Valve	Robbins Aviation	SSKG-250-4T	NA	¼-in.
9	Hand Valve	Robbins Aviation	SSKG-250-4T	NA	¼-in.
10	Hand Valve	Robbins Aviation	SSKG-250-4T	NA	¼-in.
11	Graduated Cylinder	Pyrex Co.	NA	NA	For leakage measurement
12	Water Tank	CCSD	NA	NA	Leakage detector
13	Torque Wrench	Armstrong	5R-100	NASA 95-1318B	Replaces hand wheel of specimen (when required) Cal. date 8-7-66
14	Hand Valve	Robbins Aviation	SSKG-250-4T	NA	¼-in.

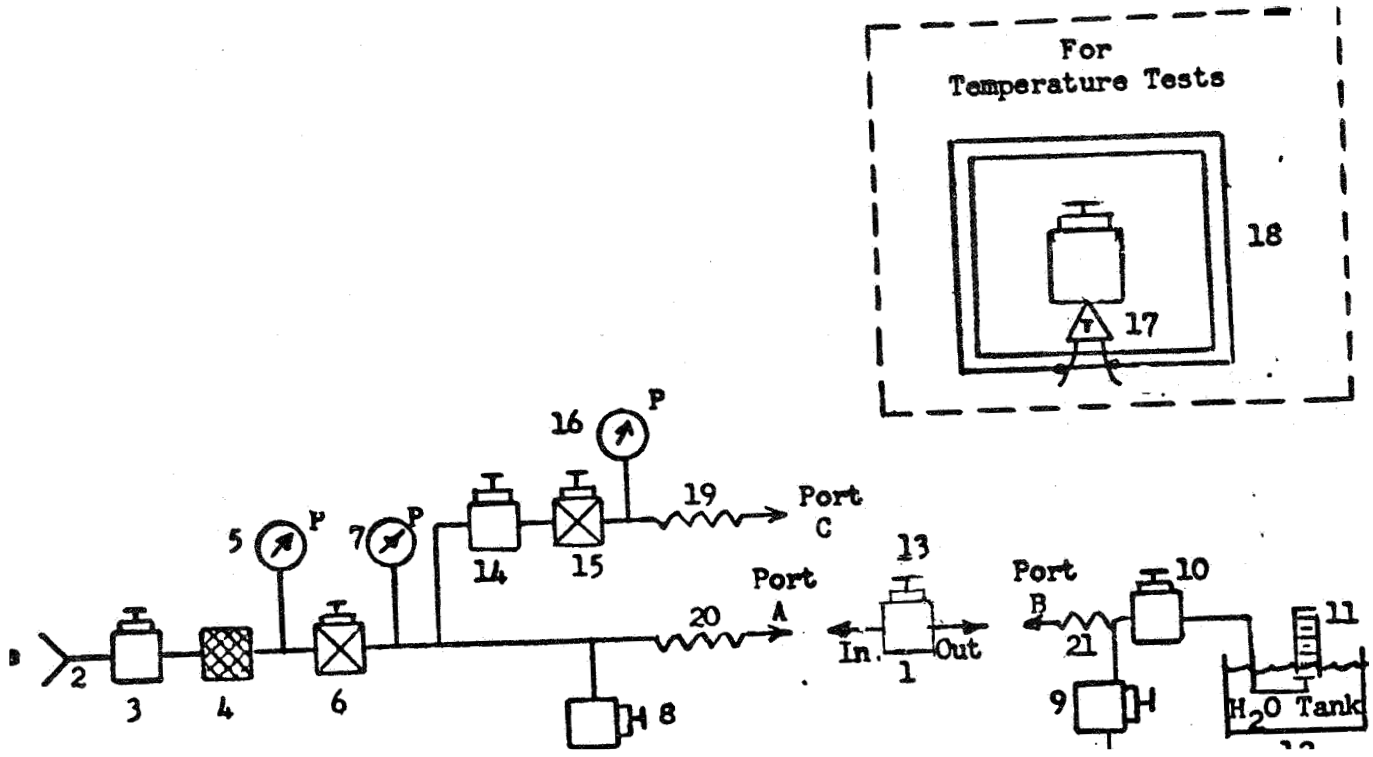
Table 4-1. Functional Test Equipment List (Continued)

Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Remarks
15	Pressure Regulator	Tescom Corp.	26-1002	1009	100-psig inlet 0-to 10-psig outlet
16	Pressure Gage	Marsh Instrument	NA	NASA 08-113-1142B	0-to 30-psig ±0.5% FS Cal. date 10-15-66
17	Thermocouple	Honeywell Corp.	30112	NA	-50 to 200 (±2.5) °F (temperature tests only)
18	Thermal Chamber	Conrad Corp.	NA	NASA 08-113-2049-41	-30 to 180°F (temperature tests only)
19	Flex Hose	NA	NA	NA	¼-in.
20	Flex Hose	NA	NA	NA	¼-in.
21	Flex Hose	NA	NA	NA	¼-in.

Table 4-2. Initial Functional Test Data

Cycle No.	Applied Seating Torque ft-lb	Inlet Port Pressurized		Outlet Port Pressurized		Breakaway Torque ft-lb		Reseating Torque ft-lb		Running Torque ft-lb			
										To Open		To Close	
		Internal Leakage scim	External Leakage scim	Internal Leakage scim	External Leakage scim	6000 psig	0 psig	6000 psig	0 psig	6000 psig	0 psig	6000 psig	0 psig
1	5.0	NR	NR	0	0								
	5.0	0	0	NR	NR								
	10.0	NR	NR	NR	NR	6.7	6.6	0.9	0.04	1.2	0.08	1.1	0.08
2	10.0	NR	NR	NR	NR	5.8	6.6	0.9	0.08	1.2	0.08	1.1	0.08
3	10.0	NR	NR	NR	NR	6.7	6.6	0.9	0.08	1.2	0.08	1.0	0.08
4	10.0	NR	NR	NR	NR	6.9	6.5	0.9	0.07	1.3	0.08	1.3	0.08
5	10.0	NR	NR	NR	NR	6.6	5.9	0.9	0.07	1.1	0.08	1.4	0.08
6	10.0	NR	NR	NR	NR	6.7	5.9	0.9	0.07	1.3	0.08	1.4	0.08
7	10.0	NR	NR	NR	NR	6.5	5.9	1.2	0.07	1.2	0.08	1.5	0.07
8	10.0	NR	NR	NR	NR	5.0	5.0	0.8	0.04	1.3	0.08	1.5	0.08
9	10.0	NR	NR	NR	NR	5.0	5.0	0.4	0.04	1.0	0.08	1.5	0.08
10	10.0	NR	NR	NR	NR	5.0	5.0	0.4	0.04	1.1	0.08	1.4	0.08

NR N Required



Note: All lines 1/4 inch.
Refer to table 4-1 for item identification.

Figure 4-1. Functional Test Schematic

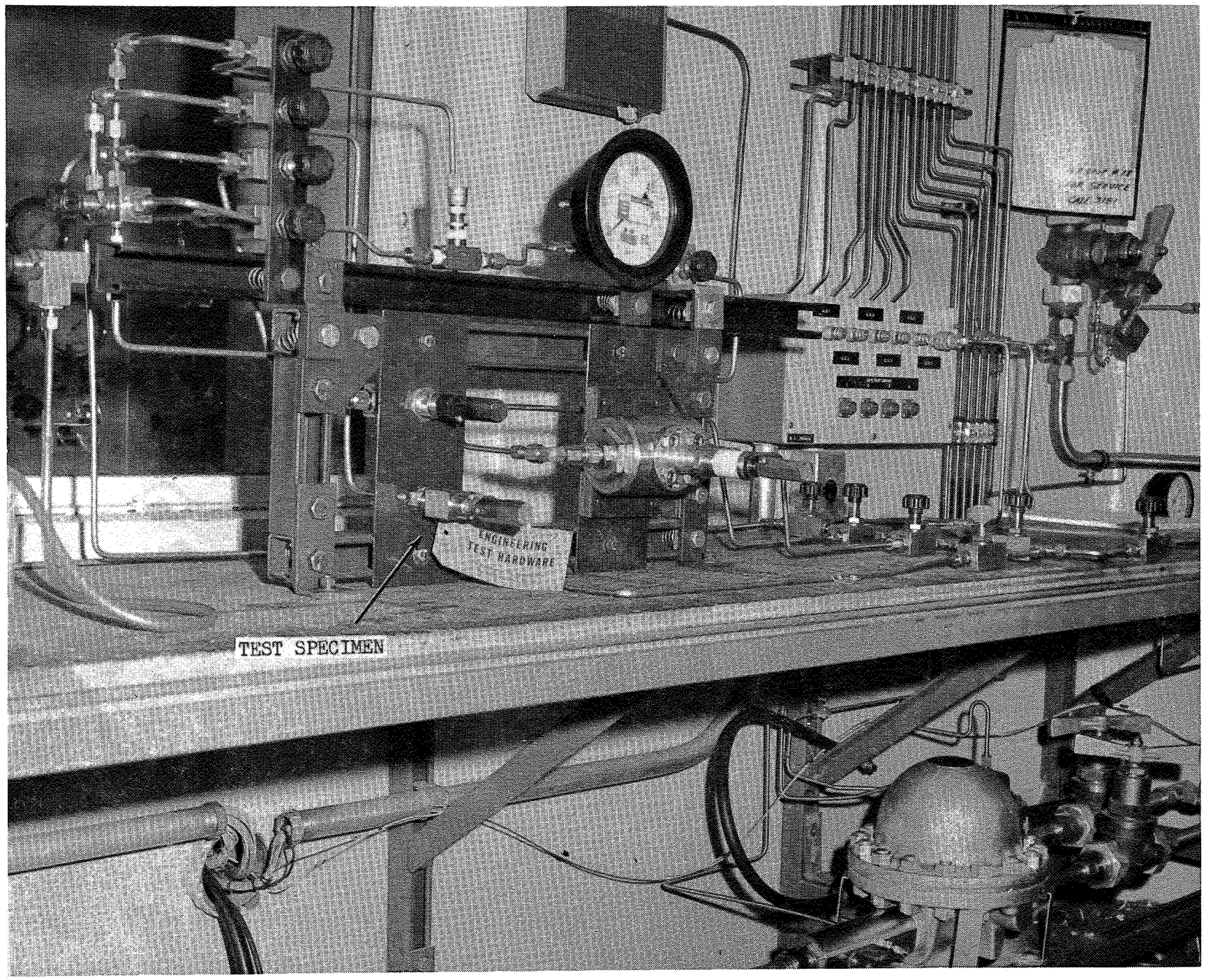


Figure 4-2. Functional Test Setup

SECTION V

FLOW TEST

5.1 TEST REQUIREMENTS

5.1.1 The valve capacity (Cv) of the specimen shall be determined,

5.1.2 A flow rate versus pressure drop curve shall be developed.

5.2 TEST PROCEDURE

5.2.1 The test setup was assembled as shown in figure 5-2 and 5-3 utilizing the equipment listed in table 5-1. All hand valves were closed,

5.2.2 Reservoir vent valve 11 was opened. Hand valve 14 was opened and reservoir 10 was filled to approximately 75 percent of its capacity,

5.2.3 Hand valves 11 and 14 were closed.

5.2.4 Hand valve 3 was opened and regulator 6 was adjusted so that 50 psig pressure was applied to the reservoir. The pressure was monitored on gage 16.

5.2.5 Valves 17 and 18 were adjusted so that flow rates of 0.5 through 3.2 gallons per minute were attained as indicated by flowmeter 19. The pressure drop across the valve and the pipe loss were read on gages 23 and 24 and were recorded. The water temperature as indicated by temperature recorder 22 was recorded.

5.2.6 For each data point, Cv was computed for the specimen by using the following formula:

$$Cv = Q\sqrt{\frac{\rho_t}{\rho \Delta P}}$$

where:

Q = measured flow rate (gpm)
ΔP = pressure drop across the specimen (psi)
ρ_t = density of the water at temperature indicated by thermocouple 21
ρ = density of water at 48°F

5.3 TEST RESULTS

5.3.1 The flow coefficient (Cv) of the 3/8 inch angle valve was an average of 0.42 when calculated over a flow range between 0.50 and 3.2 gallons water per minute.

5.3.2 The specimen showed no deterioration following the test.

5.4 TEST DATA

The test data recorded during the test and a functional following the test are presented in tables 5-2 and 5-3. Flow rate versus pressure drop is presented in figure 5-1.

Table 5-1. Flow Test Equipment List

Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Remarks
1	Test Specimen	James, Pond, & Clark, Inc.	BR949T1-6BB(T9)	60100412	Angle Valve 3/8-In.
2	Air Supply		NA	NA	3 to 3000 psig
3	Hand Valve	Combination Pump & Valve Corp.	PL-63	NA	1/2-in.
4	Filter	Bendix	1731261	NA	10-micron
5	Pressure Gage	Ashcroft	NA	95-1210-B	0-5000 psig Cal. date 11/10/66
6	Regulator	Tescom	261201-14	NA	0-4000 psig
7	Pressure Gage	Ashcroft	NA	95-1227-B	0-5000 psig Cal. date 10/3/66
8	Relief Valve	Anderson Greenwood	3TS44-2	16057	1500 psig
9	Check Valve	Crissair	2C5758	NA	3/4-in
10	Water Tank	CCSD	NA	10571	666 gal,
11	Hand Valve	Marsh Instrument	1924	NA	3/4-in.
12	Check Valve	Crissair	2C5758	NA	3/4-in.
13	Relief Valve	Anderson Greenwood	3TS44-2	15734	loo psig
14	Wand Valve	Jenkins Bros	46U	NA	1/2-in.
15	Water Supply	NOPSI	NA	NA	
16	Pressure Gage	Ashcroft	1850	9501581B	0-3000 psig ±.5% FS Cal. date 9/13/66
17	Hand Valve	Vacco	MV6P4G32G	5116-18	1/2-in.
18	Hand Valve	Vacco	NVA6P404S	19-90794	1-in,
19	Flowmeter	Cox Instrument	5262	019165	0.25 to 7.5 GPM Cal. date 11/10/66
20	Eputmeter	Beckman	5311	016578	Cal.date 9/23/66

Table 5-1. Flow Test Equipment List Continued

Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Remarks
21	Temperature Probe	Honeywell	2T2M13P	NA	Copper/Constantan
22	Temperature Recorder	Westmeter	NA	019464	-100 to +400 Cal. date 7/20/66
23	Pressure Gage	Heise	NA	93-1066-C	0-100 psig ±.1% FS Cal. date 12-14-66
24	Pressure Gage	Heise	H-41912	93-1083-C	0-100 psig ±.1% FS Cal. date 12-14-66
25	Hand Valve	Vacco	NV-6P-203-2G	2777	1/2-in.

Table 5-2. Data on Functional Test Prior to Flow Test (72 hours lapse time)

Cycle No.	Applied Seating Torque ft-lb	Inlet Port Pressurized		Outlet Port Pressurized		Breakaway Torque ft-lb		Reseating Torque ft-lb		Running Torque ft-lb			
										To Open		To Close	
		Internal Leakage scim	External Leakage scim	Internal Leakage scim	External Leakage scim	6000 psig	0 psig	6000 psig	0 psig	6000 psig	0 psig	6000 psig	0 psig
1	0.3	NR	NR	0	0								
	0.3	0	0	NR	NR								
	0.3	NR	NR	NR	NR	0.8	0.3	1.6	0.2	1.1	0.2	1.8	0.2
2	0.3	NR	NR	NR	NR	0.8	0.2	1.5	0.2	0.8	0.2	1.7	0.2
3	0.3	NR	NR	NR	NR	0.8	0.2	1.5	0.1	0.9	0.1	1.8	0.2

NR - Not Required

Table 5-3. Flow Test Data

Flow (gpm)	Specimen Pressure Upstream (psig)	Specimen Pressure Downstream (psig)	Tare (psi)	ΔP (psi)	Media Temperature (°F)	Flow Coefficient (Cv)
0.50	2.5	0.9	01	1.5	50	0.40
0.75	5.7	2.1	0.1	3.5	50	0.40
0.90	8.3	3.1	0.2	5.0	50	0.40
1.00	10.1	3.9	0.4	5.8	50	0.42
1.25	15.2	5.9	0.4	8.9	50	0.42
1.50	21.8	8.4	0.5	12.9	50	0.43
1.75	28.7	11.1	0.7	16.9	50	0.43
2.00	37.7	14.5	0.9	22.3	50	0.42
2.50	57.7	21.8	1.2	34.7	50	0.42
3.00	83.0	31.3	1.8	49.9	50	0.42
3.20	95.0	35.8	2.0	57.2	50	0.42
3.20	94.5	35.7	2.0	56.8	50	0.42
3.00	82.7	31.3	1.8	49.6	50	0.42
2.50	57.7	21.9	1.3	34.5	50	0.42
2.00	37.3	14.2	0.9	22.2	50	0.42
1.75	28.9	11.0	0.7	17.2	50	0.42
1.50	21.4	8.1	0.5	12.8	50	0.43
1.25	14.9	5.7	0.3	8.9	50	0.42
1.00	9e9	3.7	0.2	6.0	50	0.41
0.75	5.8	2.3	01	3.4	50	0.41
0.50	2.8	12	0.1	1.5	50	0.40

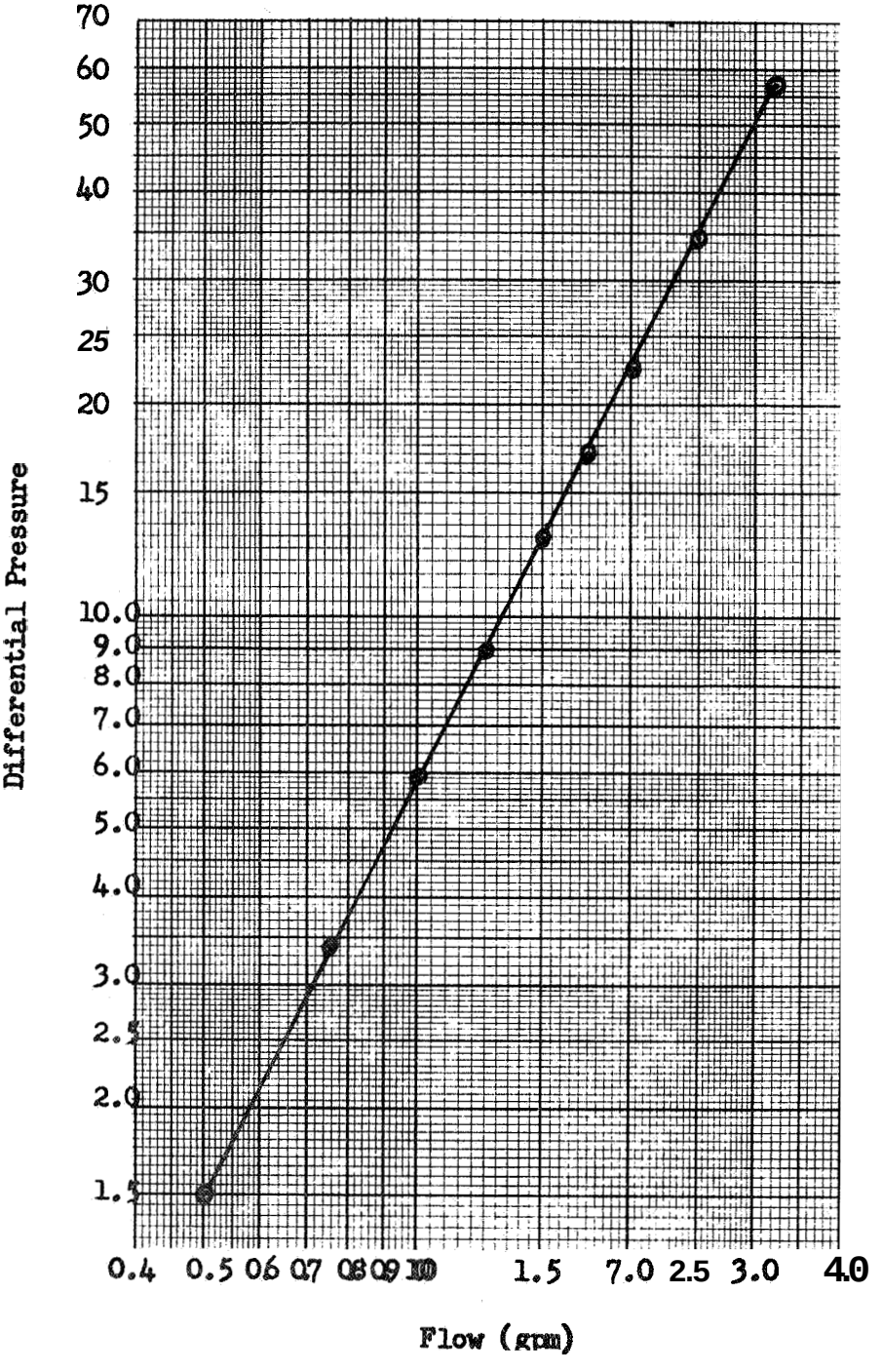
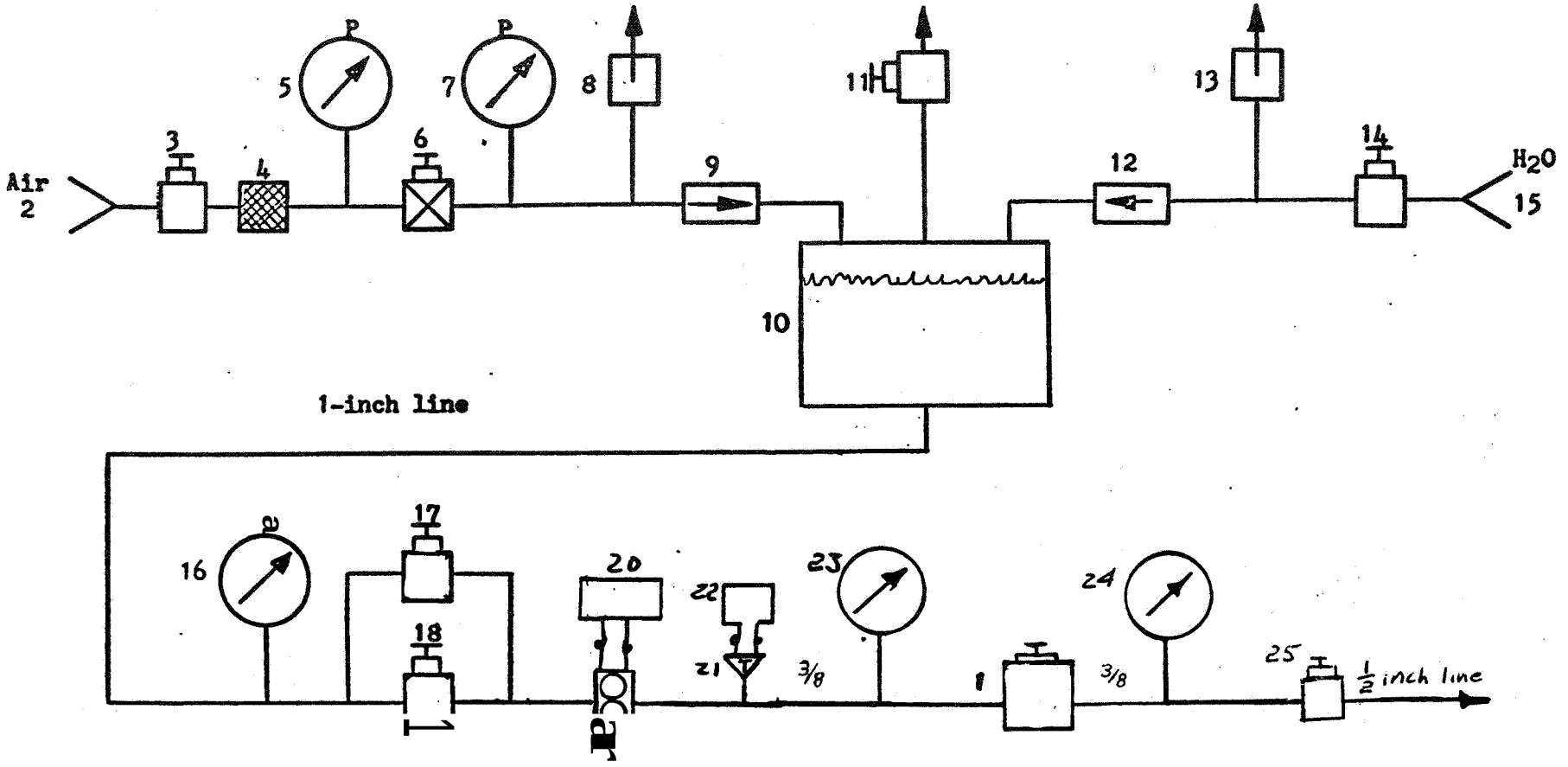


Figure 5-1. Flow Versus Differential Pressure



Note: All lines 1 inch unless otherwise indicated.
Refer to table 5-1 for item identification.

Figure 5-2. Flow Test Schematic

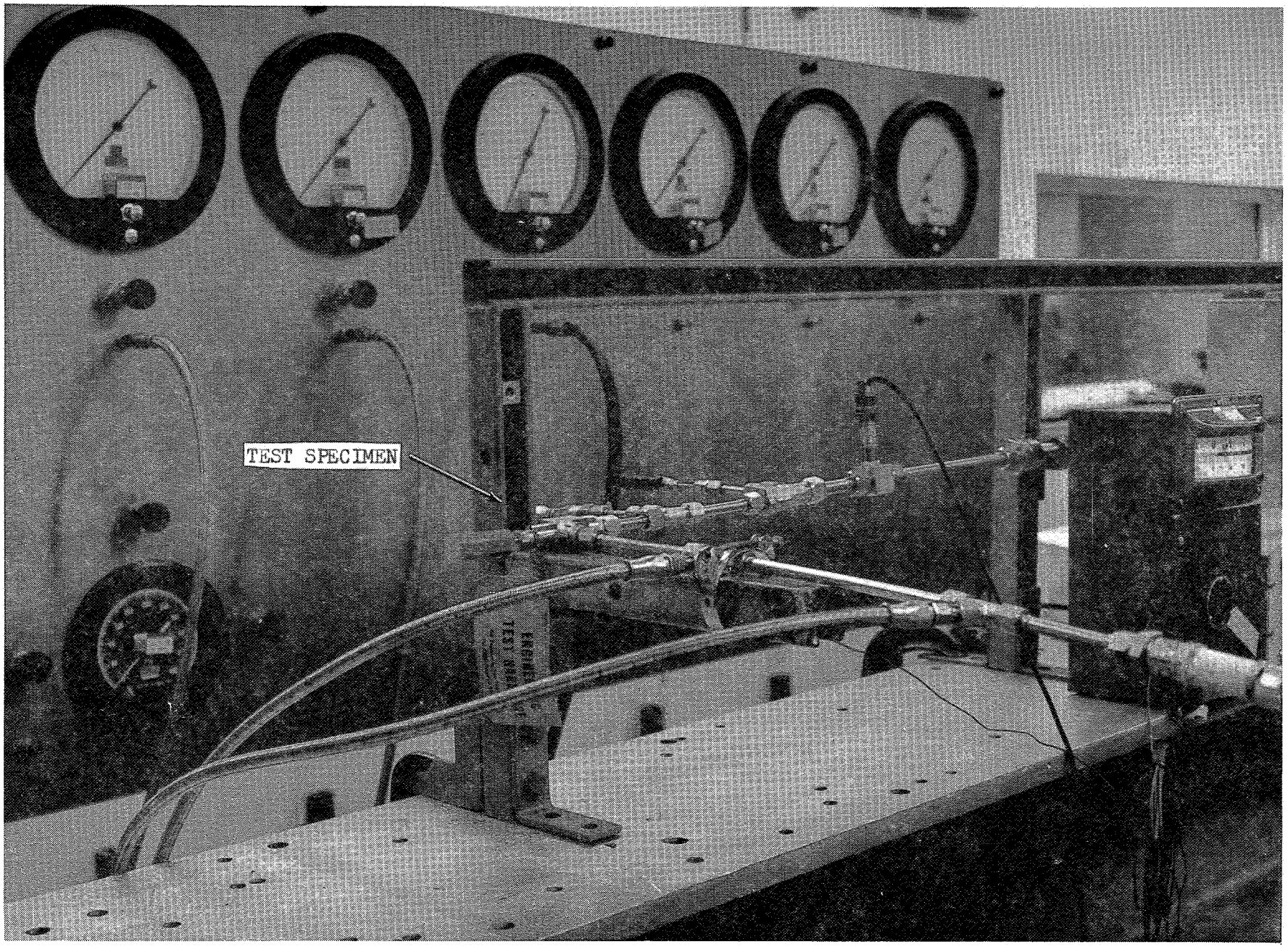


Figure 5-3. Flow Test S 4

SECTION VI

SURGE TEST

6.1 TEST REQUIREMENTS

6.1.1 The test specimen shall be subjected to 20 pressure surges, 10 with the specimen closed and 10 with the specimen partially opened. The surge test determines whether the environment causes degradation or deformation of the specimen.

6.1.2 Each pressure surge shall be a pressure increase from zero to 6000 psig within 100 milliseconds.

6.1.3 The downstream side of the specimen shall be vented after each surge, when specimen is partially opened.

6.2 TEST PROCEDURE

6.2.1 The test specimen was installed in the test setup as shown in figures 6-2 and 6-3 using the equipment listed in table 6-1. All hand valves, regulators and the specimen were closed for zero pressure.

6.2.2 Hand valve 2 was opened.

6.2.3 Pressure gage 4 indicated the supply pressure of 7000 psig.

6.2.4 Regulator 5 was adjusted until gage 6 showed 6000 psig supplied to the test setup. Hand valve 7 was opened.

6.2.5 Switch 18 was closed and solenoid valve 8 supplied 6000 psig to the inlet port of the specimen.

6.2.6 The output from pressure transducer 15 was recorded on oscillograph 16 together with the time for each run.

6.2.7 Switch 18 was opened to deactuate solenoid valve 8.

6.2.8 Procedures 6.2.5 through 6.2.7 were repeated 10 times.

6.2.9 The test sample was partially opened (cracked), and the vent port of solenoid valve 8 was capped.

6.2.10 Procedures 6.2.5 through 6.2.7 were repeated for 10 additional cycles, opening hand valve 12 after each cycle to vent the downstream pressure from the specimen.

6.2.11 The specimen was examined for distortion after each cycle and functionally tested prior to and after surge testing.

6.3 TEST RESULTS

6.3.1 The specimen was cycled ten times in the closed position with a pressure of 0 to 6000 psig and a rise rate of 75 milliseconds. The second ten cycles were performed with the valve in the partically opened position, cracked, with a 0 to 6000 psig pressure and a rise rate of 80 milliseconds. The specimen demonstrated no adverse effects from the test.

6.4 TEST DATA

6.4.1 A typical surge waveform as recorded during the test is shown in figure 6-1.

6.4.2 Data recorded during the pre-surge and post-surge functional tests are presented in tables 6-2 and 6-3.

Table 6-1. Surge and Cycle Test Equipment List

Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Remarks
1	Test Specimen	James Pond & Clark	BR949T1-6BB(T9)	6010042	Angle Valve, 3/8-in.
2	Hand Valve	Combination Pump and Valve Company	380-3	N/A	1 1/2-in. supply
3	Filter	Microporous	4813F-2M	N/A	2-micron
4	Pressure Gage	Ashcroft	N/A	NASA-08-113-200594-P	O'to 10,000 psig ±0.2% FS Cal. date 12/8/66
5	Pressure Regulator	Tescom Corp,	26-1002	1004	7000 psig Inlet, 0 to 7000 'psig outlet
6	Pressure Gage	Ashcroft	N/A	NASA-08-113-200 594-Q	0 to 10,000 psig 0.2%FS Cal. date 12/8/66
7	Hand Valve	Robbins Aviation	SSKG-250-4T	N/A	1/4-in.
8	Solenoid Valve	Marotta Valve Co.	MV-583	3696	3-Way, 1/2-in.
9	Hand Valve	Robbins Aviation	SSKG-250-4T	N/A	1/4-in.
10	Pressure Gage	Ashcroft	N/A	NASA-08-113 -200594 -B	0 to 10,00 0.2% FS Cal. date 12/8/66
11	Helium and Nitrogen Source	CCSD	N/A	N/A	7000 psig.
12	Hand Valve	Robbin Aviation	S5KG-250-4T	N/A	1/4-in.
13	Solenoid Valve	Marotta Valve Co.	MV-583	2916	3-way, 1/2-in.
14	Motor and Gear	Westinghouse	N/A	N/A	System Constructed by NASA

Table 6-1. (continued)

Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Remarks
15	Pressure Transducer	Statham	12210	106-1111-B	0 to 7,500 psig, ±0.2% Cal, date 10/4/66
16	Oscillograph Recorder	C.E.C.	5-124	NASA-017887	Recording Cal.date 12/19/66
17	Electrical Supply	Plant Services	N/A	N/A	28 vdc and 115 vac
18	Switch	Cutler-Hammer	N/A	N/A	SPST

Table 6-2. Data on Functional Test Prior to Surge Test (72 Hours Lapse Time)

Cycle No.	Applied Seating Torque ft-lb	Inlet Port Pressurized		Outlet Port Pressurized		Breakaway Torque ft-lb		Reseating Torque ft-lb		Running Torque ft-lb			
										To Open		To Close	
		Internal Leakage scim	External Leakage scim	Internal Leakage scim	External Leakage scim	6000 psig	0 psig	6000 psig	0 psig	6000 psig	0 psig	6000 psig	0 psig
1	0.3	NR	NR	0	0								
	0.3	0	0	NR	NR								
	0.3	NR	NR	NR	NR	0.6	p2	0.9	0.08	1.5	0.08	1.8	0.08
2	0.3	NR	NR	NR	NR	0.6	p2	0.9	0.08	1.5	0.08	2.1	0.08
3	0.3	NR	NR	NR	NR	0.7	p2	1.0	0.08	1.7	0.08	2.1	0.08

NR - Not Required

Table 6-3. Data on Functional Test Following the Surge Test

Cycle No.	Applied Seating Torque ft-lb	Inlet Port Pressurized		Outlet Port Pressurized		Breakaway Torque ft-lb		Reseating Torque ft-lb		Running Torque ft-lb			
										To Open		To Close	
		Internal Leakage scim	External Leakage scim	Internal Leakage scim	External Leakage scim	6000 psig	0 psig	6000 psig	0 psig	6000 psig	0 psig	6000 psig	0 psig
1	0.3	NR	NR	0	0								
	0.3	0	0	NR	NR								
	0.3	NR	NR	NR	NR	0.6	0.3	1.1	0.N	1.3	0.08	1.8	0.04
2	0.3	NR	NR	NR	NR	0.9	0.2	1.1	0.2	1.2	0.04	1.8	0.04
3	0.3	NR	NR	NR	NR	0.9	0.2	1.1	0.2	1.6	0.06	1.9	0.06

NR - Not Required

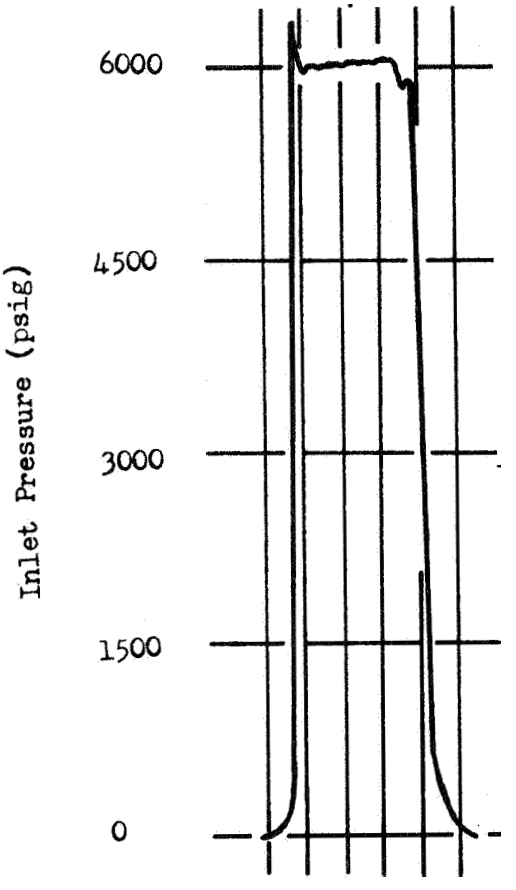
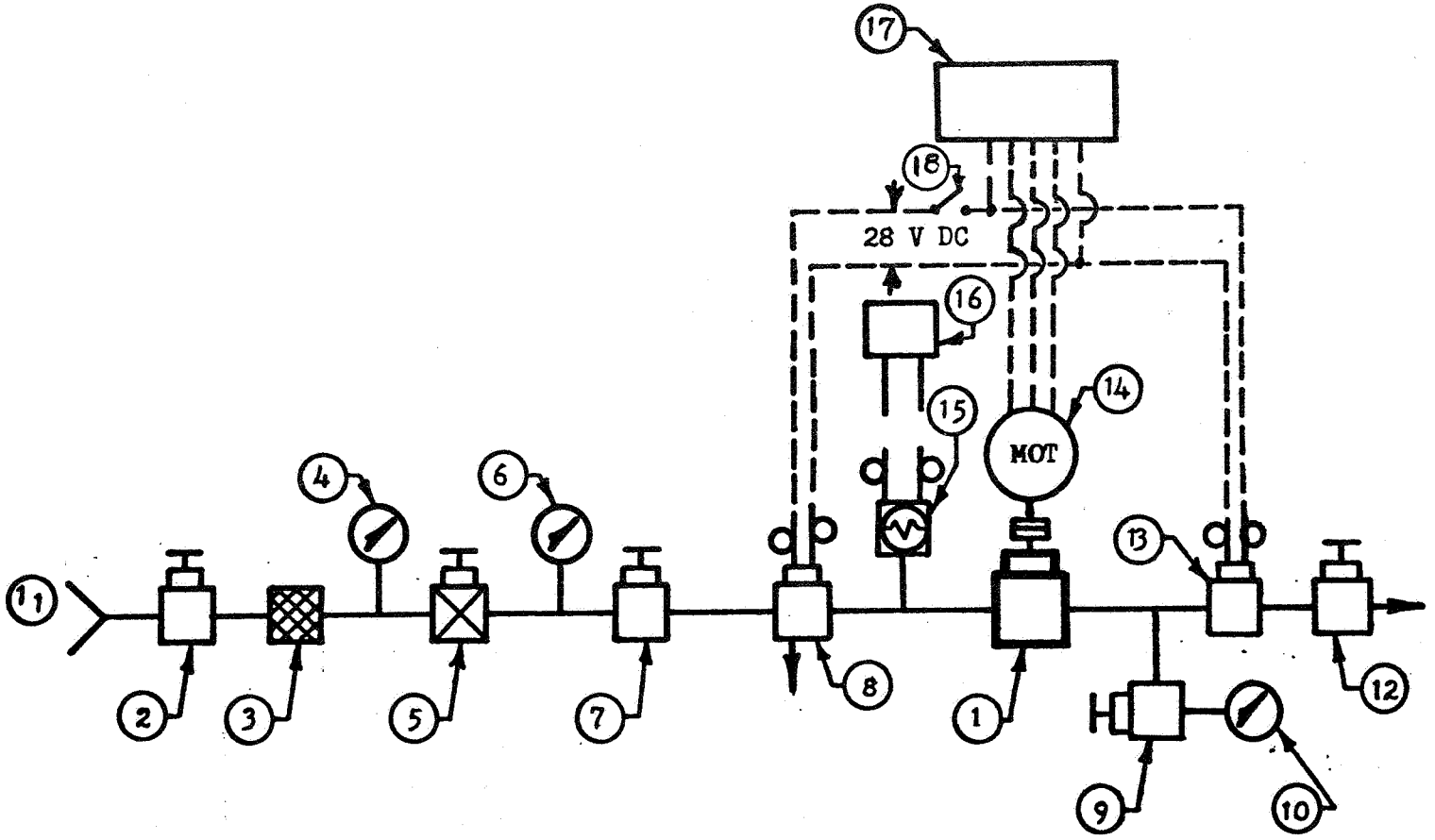


Figure 6-1. Typical **Surge Waveform**



Note: All lines $\frac{1}{2}$-Inch
Refer to Table 6-1 for item identification

Figure 6-2. Surge and Life Cycle Test Schematic

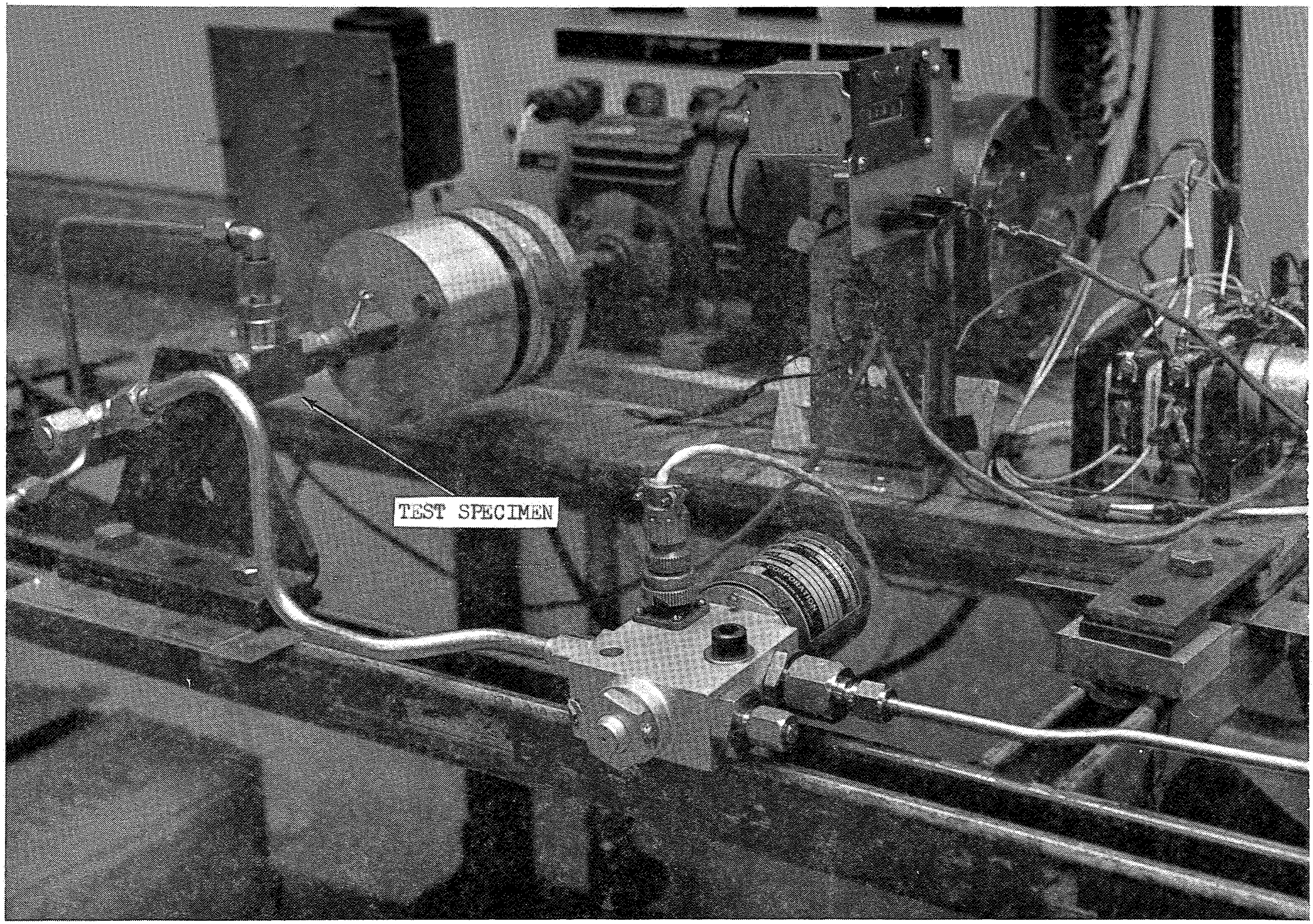


Figure 6-3. Surge and Cycle Test Setup

SECTION VII

LOW TEMPERATURE TEST

7.1 TEST REQUIREMENTS

7.1.1. The test specimen shall be subjected to a low temperature test at +5 (+0,-4)°F to determine whether the environment causes degradation of deformation.

7.1.2 The test specimen shall be subjected to a functional test in accordance with section IV during the low temperature test using helium as the test medium.

7.2 TEST PROCEDURE

7.2.1 The test specimen was installed in the test setup as shown in figures 4-1, 7-1 and 7-2, using the test equipment listed in table 4-1.

7.2.2 With thermocouple 17 affixed to the specimen the thermal chamber 18 was cooled to +5°F and the relative humidity maintained at the prescrfbed 60 to 90 percent.

7.2.3 Temperature stabilization was achieved and a functional test was performed.

7.2.4 The chamber was returned to ambient temperature and a second functional was performed.

7.2.5 The specimen was visually inspected within one hour after its return to ambient temperature.

7.3 TEST RESULTS

7.3.1 The specimen demonstrated no apparent adverse effects from thermal changes except for a slight increase in the low-pressure torque- values as recorded in the functional data.

7.4 TEST DATA

The data recorded during the test are preaented in tables 6-1 and 7-2.

Table 7-1. Data on Functional Test at 5°F

Cycle No.	Applied Seating Torque ft-lb	Inlet Port Pressurized		Outlet Port Pressurized		Breakaway Torque ft-lb		Reseating Torque ft-lb		Running Torque ft-lb			
										To Open		To Close	
		Internal Leakage scim	External Leakage scim	Internal Leakage scim	External Leakage scim	6000 psig	0 psig	6000 psig	0 psig	6000 psig	0 psig	6000 psig	0 psig
1	0.3	NR	NR	0	0								
	0.3	0	0	NR	NR								
	0.3	NR	NR	NR	NR	0.5	0.8	1.1	0.08	0.8	0.08	1.3	0.08
2	1.3	NR	NR	NR	NR	1.4	0.9	2.3	0.2	1.8	0.04	1.4	0.04
3	1.5	NR	NR	NR	NR	1.4	1.0	1.6	0.2	1.3	0.02	1.5	0.04

NR - Not Required

Table 7-2. Data on Functional Test at Ambient Conditions

Cycle No.	Applied Seating Torque ft-lb	Inlet Port Pressurized		Outlet Port Pressurized		Breakaway Torque ft-lb		Reseating Torque ft-lb		Running Torque ft-lb			
										To Open		To Close	
		Internal Leakage scim	External Leakage scim	Internal Leakage scim	External Leakage scim	6000 psig	0 psig	6000 psig	0 psig	6000 psig	0 psig	6000 psig	0 psig
1	0.3	NR	NR	0	0								
	0.3	0	0	NR	NR								
	0.3	NR	NR	0	0	0.7	0.2	1.1	0.1	1.3	0.2	2.0	0.1
2	0.3	NR	NR	0	0	0.7	0.3	1.1	0.2	1.4	0.2	1.9	0.1
3	0.3	NR	NR	0	0	0.7	0.3	1.1	0.1	1.2	0.1	1.8	0.1

NR - Not REquired

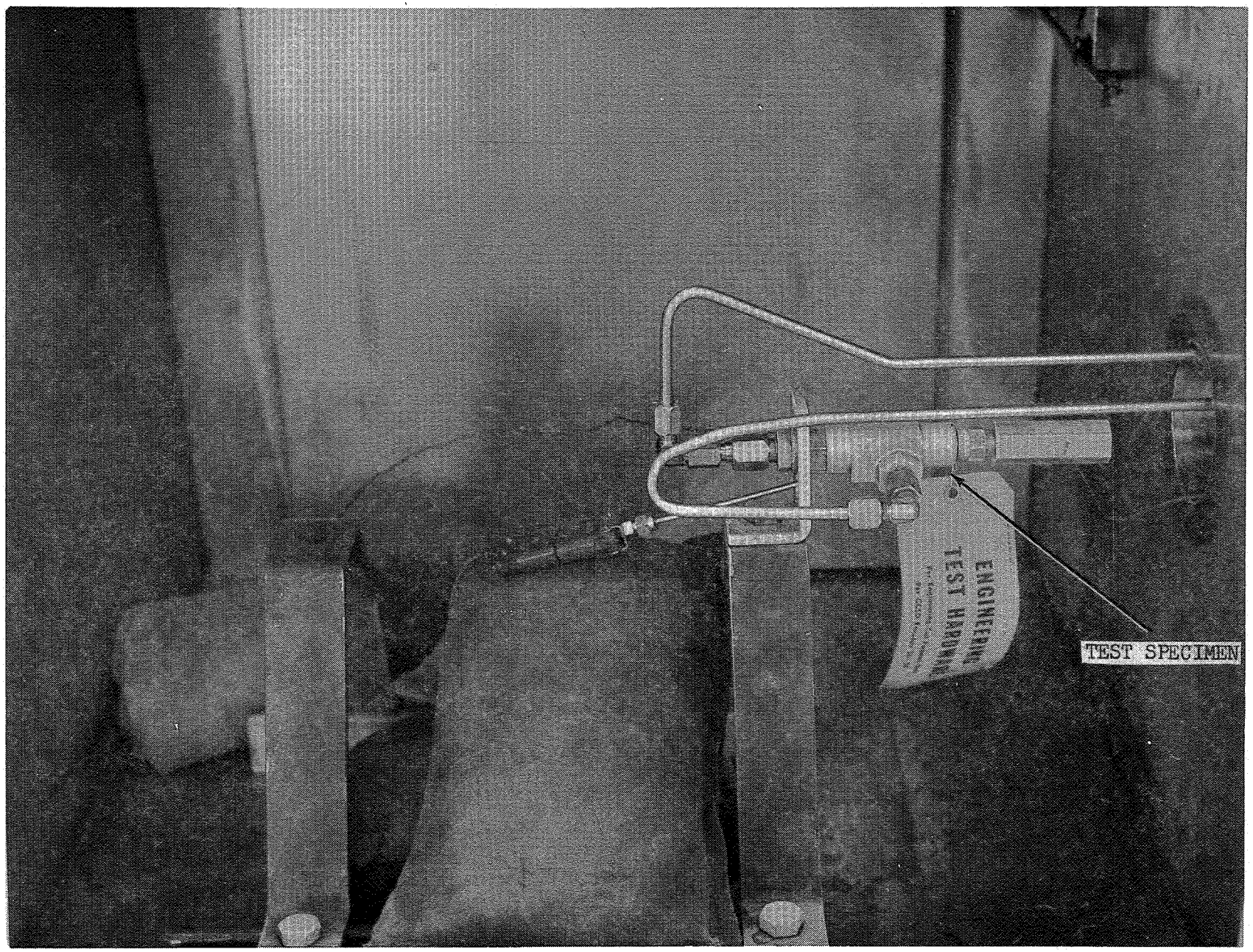


Figure 7-1. Low and High Temperature Test Setup

Figure 7-2. Low and High Temperature Test Equipment

SECTION VIII

HIGH TEMPERATURE TEST

8.1 TEST REQUIREMENTS

8.1.1 The test specimen **shall** be subjected to a high temperature test at 160 (+4,-0)°F for a period of 72 (+2,-0) hours to determine if the environment causes degradation of performance.

8.1.2 The test specimen shall be subjected to a functional test in accordance with section IV during and after the high temperature test using helium as the test medium.

8.2 TEST PROCEDURE

F.2.1 The test specimen ***was*** installed in the test setup as shown in figures 4-1, 7-1 and 7-2 using the equipment listed in table 4-1.

8.2.2 With the thermocouple 17 affixed to the specimen, the temperature of the thermal chamber 18 was increased to 160°F at a rise rate of approximately 1° per minute. The humidity was maintained at 20 percent.

8.2.3 This temperature was maintained for 72 hours after temperature stabilization.

8.2.4 A functional test was performed while the sample and chamber were at 160°F.

8.2.5 The chamber temperature was returned to ambient conditions upon completion of the functional test.

8.2.6 Within one hour following the establishment of ambient conditions, a visual inspection and functional test, was performed on the specimen.

8.3 TEST RESULTS

The test specimen demonstrated no adverse effects from the thermal change.

8.4 TEST DATA

The data recorded during and after the test are presented in tables 8-1 and 8-2.

Table 8-1. Data on Functional Test at +160°F

Cycle No.	Applied Seating Torque ft-lb	Inlet Port Pressurized		Outlet Port Pressurized		Breakaway Torque ft-lb		Reseating Torque ft-lb		Running Torque ft-lb			
										To Open		To Close	
		Internal Leakage scim	External Leakage scim	Internal Leakage scim	External Leakage scim	6000 psig	0 psig	6000 psig	0 psig	6000 psig	0 psig	6000 psig	0 psig
1	4.	NR	NR	0	0								
	4	0	0	NR	NR								
	4	NR	NR	NR	NR	2.0	2.6	3.9	1.9	1.3	0.04	1.9	0.04
2	4	NR	NR	NR	NR	3.0	2.3	3.9	1.7	1.5	0.08	2.1	0.08
3	4	NR	NR	NR	NR	3.3	2.4	3.6	1.7	1.4	0.08	2.0	0.08

NR - Not Required

Table 8-2. Data on Functional Test at Ambient Conditions

Cycle No.	Applied Seating Torque ft-lb	Inlet Port Pressurized		Outlet Port Pressurized		Breakaway Torque ft-lb		Reseating Torque ft-lb		Running Torque ft-lb			
										To Open		To Close	
		Internal Leakage scim	External Leakage scim	Internal Leakage scim	External Leakage scim	6000 psig	0 psig	6000 psig	0 psig	6000 psig	0 psig	6000 psig	0 psig
1	4.	NR	NR	0	0								
	4	0	0	NR	NR								
	4	NR	NR	NR	NR	3.3	2.9	4.0	1.7	1.1	0.2	1.7	0.2
2	4	NR	NR	NR	NR	2.7	1.3	4.0	1.8	1.3	0.08	2.0	0.2
3	4	NR	NR	NR	NR	3.4	1.3	4.0	1.9	1.0	0.08	1.7	0.08

NR - Not Required

SECTION IX

CYCLE TEST

9.1 TEST REQUIREMENTS

9.1.1 The test specimen shall be subjected to 1000 cycles during the cycle test.

9.1.2 Each cycle shall consist of pressurizing the inlet port to 6000 psig and then opening and closing the specimen. GN_2 shall be the test medium.

9.1.3 The specimen downstream pressure will be vented to below 3100 psig after each cycle,

9.1.4 A functional test, as specified in section IV, shall he Performed following the completion of 50, 100, 500 and 1000 cycles.

9.2 TEST PROCEDURE

9.2.1 The specimen was installed in the test setup as shown in figures 6-2 and 6-3 utilizing the equipment listed in table 6-1.

9.2.2 All. hand valves and regulator 5 were adjusted for zero pressure.

9.2.3 Hand valve 2 was opened and gage 4 was monitored for a 7000 psig reading. Hand valve 9 was opened.

9.2.4 Regulator 5 was adjusted to establish a 6000 psig reading on gage 6 and hand valve 7 was opened.

9.2.5 The electrical network was adjusted to produce the following:

a. Solenoid valve 8 was actuated to pressurize the specimen to 6000 psig, read from gage 6.

b. Solenoid valve 13 was actuated to close the outlet port during specimen opening and closing. Hand valve 12 was partially opened.

c. Switch 18 was closed to signal the 440 vac reversible electrical motor 14 to open and close the specimen.

d. Solenoid valves 8 and 13 were deactuated tc vent pressure from the specimen to below 3100 psig downstream, read from gage 10.

9.2.6 Functional tests were performed after 50, 100, 500 and 1000 cycles of the specimen.

9.3 TEST RESULTS

9.3.1 After 143 cycles, the torque required to operate the valve exceeded the 10 foot-pounds seating and the 5 foot-pounds running torque, Disassembly of the valve revealed that the threads of the valve stem and also the packing gland had failed by excessive wear.

9.3.2 The specimen was rebuilt by the vendor and returned. A complete functional test was performed before cycle testing was continued.

9.3.3 The rebuilt specimen performed satisfactorily during and after 1000 cycles of operation.

9.4 TEST DATA

9.4.1 Functional test data after 50 and 100 cycles are shown in tables 9-1 and 9-2.

9.4.2 Complete functional test data after the valve was rebuilt by the vendor and functional test data following 50, 100, 500 and 1000 cycles are shown in tables 9-3 through 9-7.

9.4.3 Figure 9-1 shows actual damage to the specimen after 143 cycles.

Table 9-1. Data on Functional Test After 50 Cycles

Cycle No.	Applied Seating Torque ft-lb	Inlet Port Pressurized		Outlet Port Pressurized		Breakaway Torque ft-lb		Reseating Torque ft-lb		Running Torque ft-lb			
										To Open		To Close	
		Internal Leakage scim	External Leakage scim	Internal Leakage scim	External Leakage scim	6000 psig	0 psig	6000 psig	0 psig	6000 psig	0 psig	6000 psig	0 psig
1	8.3.	NR	NR	0	0								
	8.3	0	0	NR	NR								
	8.3	NR	NR	NR	NR	5.8	5.8	8.2	4.2	1.5	0.5	1.9	0.4
2	8.2	NR	NR	NR	NR	5.8	5.0	7.9	3.4	1.6	0.6	1.8	0.4
3	8.2	NR	NR	NR	NR	5.4	5.4	8.6	3.5	1.5	0.6	1.6	0.4

N N quir

9-2. Data on Functional Test After 100 Cycles

Cycle No.	Applied Seating Torque ft-lb	Inlet Port Pressurized		Outlet Port Pressurized		Breakaway Torque ft-lb		Reseating Torque ft-lb		Running Torque ft-lb			
										To Open		To Close	
		Internal Leakage scim	External Leakage scim	Internal Leakage scim	External Leakage scim	6000 psig	0 psig	6000 psig	0 psig	6000 psig	0 psig	6000 psig	0 psig
1	8.3.	NR	NR	0	0								
	8.3	0	0	NR	NR								
	8.3	NR	NR	NR	NR	5.8	5.0	7.9	2.7	2.0	0.5	2.3	0.4
cum	7.5	NR	NR	NR	NR	5.4	3.4	5.4	1.8	2.0	0.4	2.3	0.3
	5.0	NR	NR	NR	NR	4.6	4.2	5.4	1.9	1.7	0.7	1.8	0.6

Note: Specimen exceeded 10 ft-lbs. seating and 5 ft-lbs. running torque after 143 cycles. Threads of the valve stem and damaged packing gland required valve rebuilding.

NR – Not Required

Table 9-3. Data on Functional Test After Specimen was Rebuilt

Cycle No.	Applied Seating Torque ft-lb	Inlet Port Pressurized		Outlet Port Pressurized		Breakaway Torque ft-lb		Reseating Torque ft-lb		Running Torque ft-lb			
										To Open		To Close	
		Internal Leakage scim	External Leakage scim	Internal Leakage scim	External Leakage scim	6000 psig	0 psig	6000 psig	0 psig	6000 psig	0 psig	6000 psig	0 psig
1	3.4.	NR	NR	0	0								
	3.4	0	0	NR	NR								
	3.4	NR	NR	NR	NR	2.1	0.8	2.5	1.7	1.3	0.04	1.5	0.04
2		NR	NR	NR	NR	1.7	0.8	2.5	1.7	1.3	0.04	1.5	0.04
3		NR	NR	NR	NR	1.7	0.8	2.5	1.7	1.0	0.04	1.5	0.04
4		NR	NR	NR	NR	1.7	0.8	2.5	1.7	1.3	0.04	1.6	0.04
5		NR	NR	NR	NR	1.7	0.8	2.5	1.7	1.4	0.04	1.6	0.04
6		NR	NR	NR	NR	1.7	0.8	2.1	1.7	1.4	0.04	1.6	0.04
7		NR	NR	NR	NR	1.5	0.8	2.5	1.7	1.4	0.04	1.6	0.04
8		NR	NR	NR	NR	1.7	0.8	2.1	1.7	1.3	0.04	1.6	0.04
9		NR	NR	NR	NR	1.5	0.8	2.1	1.7	1.4	0.04	1.5	0.04
10		NR	NR	NR	NR	1.5	0.8	2.1	1.7	1.4	0.04	1.5	0.04

N N ir

Table 9-4. Data on Functional Test After 50 Cycles (Rebuilt Valve)

Cycle No.	Applied Seating Torque ft-lb	Inlet Port Pressurized		Outlet Port Pressurized		Breakaway Torque ft-lb		Reseating Torque ft-lb		Running Torque ft-lb			
										To Open		To Close	
		Internal Leakage scim	External Leakage scim	Internal Leakage scim	External Leakage scim	6000 psig	0 psig	6000 psig	0 psig	6000 psig	0 psig	6000 psig	0 psig
1	2.5.	NR	NR	0	0								
	2.5	0	0	NR	NR								
	2.5	NR	NR	NR	NR	2.3	1.0	2.5	1.7	1.0	0.0	1.5	0.0
2	2.5	NR	NR	NR	NR	1.8	1.3	2.5	1.7	0.9	0.0	1.5	0.0
3	2.5	NR	NR	NR	NR	1.8	1.3	2.5	1.7	1.0	0.0	1.5	0.0

NR - Not Required

Table 9-5. Data on Functional Test After 100 Cycles (Rebuilt Valve)

Cycle No.	Applied Seating Torque ft-lb	Inlet Port Pressurized		Outlet Port Pressurized		Breakaway Torque ft-lb		Reseating Torque ft-lb		Running Torque ft-lb			
										To Open		To Close	
		Internal Leakage scim	External Leakage scim	Internal Leakage scim	External Leakage scim	6000 psig	0 psig	6000 psig	0 psig	6000 psig	0 psig	6000 psig	0 psig
1	2.5.	NR	NR	0	0								
	2.5	0	0	NR	NR								
	2.5	NR	NR	NR	NR	2.5	1.4	2.5	1.7	0.8	0.0	1.3	0.0
2	2.5	NR	NR	NR	NR	2.1	1.4	2.5	1.7	0.8	0.0	1.3	0.0
3	2.5	NR	NR	NR	NR	2.1	1.4	2.5	1.7	0.8	0.0	1.4	0.0

NR - Not Required

Table 9-6. Data on Functional Test After 500 Cycles (Rebuilt Valve)

Cycle No.	Applied Seating Torque ft-lb	Inlet Port Pressurized		Outlet Port Pressurized		Breakaway Torque ft-lb		Reseating Torque ft-lb		Running Torque ft-lb			
										To Open		To Close	
		Internal Leakage scim	External Leakage scim	Internal Leakage scim	External Leakage scim	6000 psig	0 psig	6000 psig	0 psig	6000 psig	0 psig	6000 psig	0 psig
1	2.5.	NR	NR	0	0								
	2.5	0	0	NR	NR								
	2.5	NR	NR	NR	NR	1.8	0.8	2.5	1.7	1.2	0.0	1.8	0.0
2	2.5	NR	NR	NR	NR	1.7	1.0	2.5	1.7	1.4	0.0	1.7	0.0
3	2.5	NR	NR	NR	NR	1.7	0.8	2.1	1.7	1.4	0.0	1.8	0.0

NR - Not Required

Table 9-7. Data on Functional Test After 1000 Cycle (Rebuilt Valve)

Cycle No.	Applied Seating Torque ft-lb	Inlet Port Pressurized		Outlet Port Pressurized		Breakaway Torque ft-lb		Reseating Torque ft-lb		Running Torque ft-lb			
										To Open		To Close	
		Internal Leakage scim	External Leakage scim	Internal Leakage scim	External Leakage scim	6000 psig	0 psig	6000 psig	0 psig	6000 psig	0 psig	6000 psig	0 psig
1	2.5.	NR	NR	0	0								
	2.5	0	0	NR	NR								
	2.5	NR	NR	NR	NR	1.7	2.1	3.3	1.7	1.5	0.3	1.8	0.08
2	3.3	NR	NR	NR	NR	2.5	1.7	2.5	1.7	1.3	0.3	1.7	0.10
3	2.5	NR	NR	NR	NR	1,7	1.7	3.3	1.7	1.5	0.3	1.7	0.08

NR - Not Required

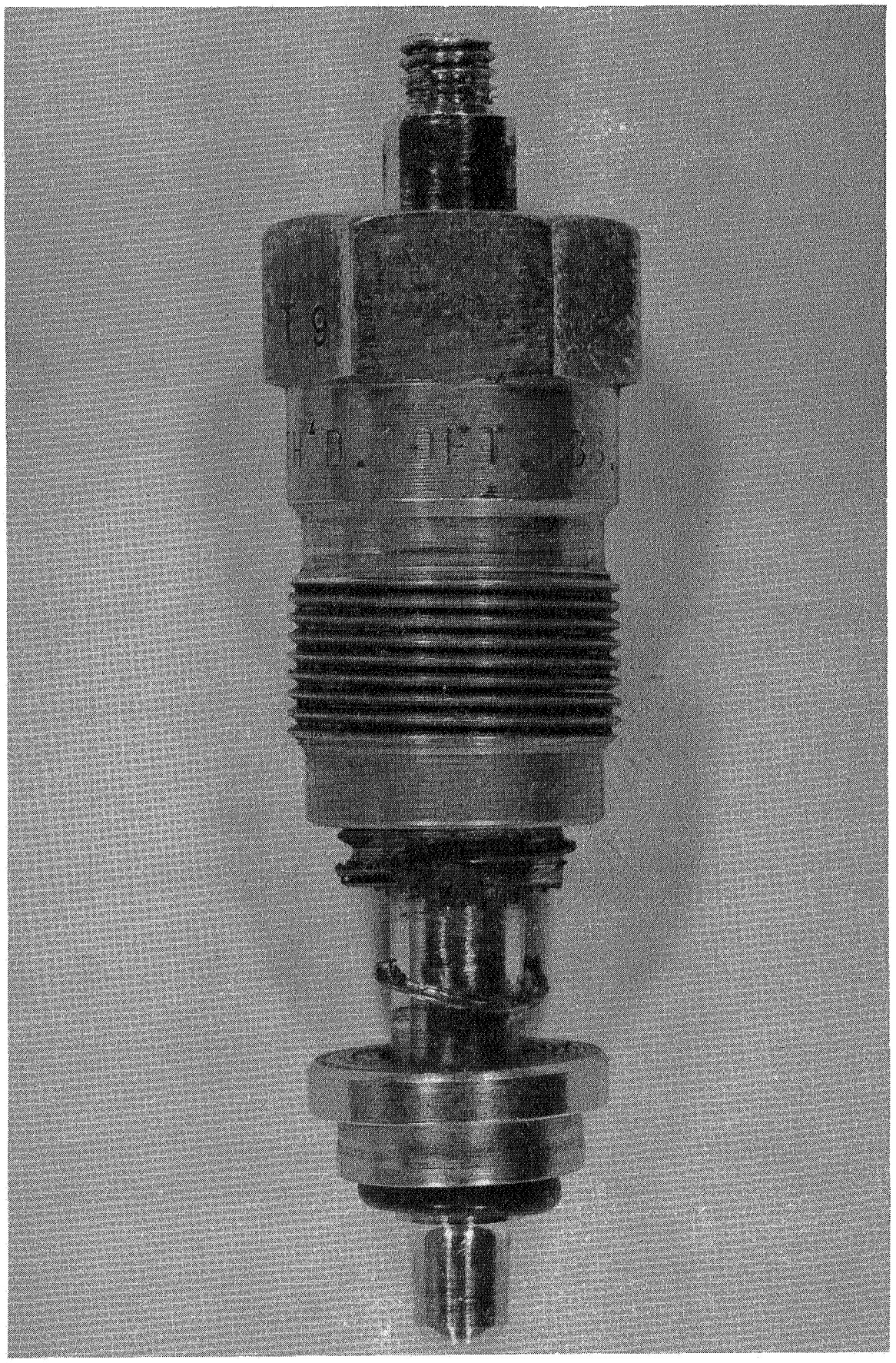


Figure 9-1. Specimen Failure After 143 Cycles

SECTION X

SAND AND DUST TEST

10.1 TEST REQUIREMENTS

1.0.1.1 A sand and dust test shall be performed on the test specimen to determine if sand particles can cause malfunction.

10.1.2 Sand and dust shall meet the requirements as specified in 10.1.3 through 10.1.8.

10.1.3 100 percent of the sand and dust shall pass through a 100-mesh screen, U. S. standard sieve series.

10.1.4 98 (+2) percent of the sand and dust shall pass through a 140-mesh-screen, U. S. standard sieve series,

10.1.5 90 (±2) percent of the sand and dust shall pass through a 200-mesh screen, U. S. standard sieve series.

10.1.6 75 (±2) percent of the sand and dust shall pass through a 325-mesh-screen, U. S. standard sieve series.

10.1.7 Chemical analysis of the dust shall be as follows:

Substance	Percent by Weight
SiO_2	97 to 99
Fe_2O_3	0 to 2
Al_2O_3	0 to 2
TiO_2	0 to 2
MgO	0 to 1
Inorganie losses	0 to 1

10.1.8 A test chamber capable of maintaining the temperature at 77°F and 160°F with 100-to 500-cfm air velocity available shall be used.

10.2 TEST PROCEDURE

10.2.1 The inlet and outlet ports were capped and the test specimen was placed in a sand and dust chamber.

10.2.2 The density of the sand and dust was maintained at 0.1 to 0.25 gram per cubic foot.

10.2.3 The internal temperature of the test chamber was set at 77°F for a period of 2 hours with an air velocity through the test chamber of 100 to 500 feet per minute.

10.2.4 Immediately following the 2-hour period, the temperature was raised to 160°F and maintained for a period of 2 hours.

10.2.5 The test specimen was removed from the test chamber after the 2-hour exposure period and allowed to cool to ambient temperature.

10.2.6 The accumulated dust was removed from the specimen by carefully brushing, wiping, and shaking. The test specimen was then examined for internal sand accumulation.

10.2.7 Upon completion of the sand and dust test, a functional test was performed as specified in section IV.

10.3 TEST RESULTS

The test specimen shared no deterioration or deformation after the sand and dust test.

10.4 TEST DATA

10.4.1 Functional test data recorded following the sand and dust test are presented in table 10-1.

10.4.2 A report on the sand and dust environment test performed by Associated Testing Laboratories, Inc., is shown in appendix I.

Table 10-1. Data on Functional Test Following the Sand and Dust Test

Cycle No.	Applied Seating Torque ft-lb	Inlet Port Pressurized		Outlet Port Pressurized		Breakaway Torque ft-lb		Reseating Torque ft-lb		Running Torque ft-lb			
										To Open		To Close	
		Internal Leakage scim	External Leakage scim	Internal Leakage scim	External Leakage scim	6000 psig	0 psig	6000 psig	0 psig	6000 psig	0 psig	6000 psig	0 psig
1	2.5.	NR	NR	0	0								
	2.5	0	0	NR	NR								
	2.5	NR	NR	NR	NR	1.7	1.0	2.5	1.7	0.8	0.08	1.5	0.08
2	2.5	NR	NR	NR	NR	1.7	0.8	2.5	1.7	0.8	0.08	1.7	0.08
3	2.5	NR	NR	NR	NR	1.7	0.8	2.5	1.7	0.9	0.08	1.7	0.08

NR - Not Required

SECTION XI

SALT FOG TEST

11.1 TEST REQUIREMENTS

11.1.1 A salt fog test shall be performed per KSC-STD-164(D), section 17, to determine the corrosive resistance of the test specimen.

11.1.2 The test shall be conducted with a temperature in the exposure zone maintained at 95 (+2, -4)°F. The salt fog conditions maintained in all parts of the exposure zone shall be such that a clean fog-collecting receptacle placed at any point in the exposure zone will collect from 0.5 to 3 milliliters of solution per hour for each 80 square centimeters of horizontal collecting area (10 centimeters diameter) based on an average test of at least 16 hours.

11.1.3 The salt used shall be sodium chloride containing, on the dry basis, not, more than 0.1 percent of sodium iodide and not more than 0.2 percent of total impurities. Unless otherwise specified, a solution shall consist of 5 parts by weight of salt in 95 parts by weight of water containing not more than 200 parts per million of total solids. The solution shall be kept free from solids by filtration or decantation. The solution shall be adjusted to and maintained at a specific gravity of from 1.023 to 1.037 and a reference temperature of 95°F. The pH of the salt solution shall be so maintained that, the solution atomized at 95 (+2, -4)°F and collected by the method specified in the 12.1.1, will be in the pH range of 6.5 to 7.2 Only diluted chemically pure (CP) hydrochloric acid or CP sodium hydroxide shall be used to adjust the pH.

11.1.4 The solution shall be collected by placing a minimum of two receptacles such that one is placed nearest to any nozzle and one is farthest from all nozzles. Receptacles shall be placed so that they are not shielded by the test specimen and so that, no drops of solution from the test specimen or other sources will be collected. The solution shall have the specified sodium chloride content and pH value when measured at a temperature of 95 (+2, -4)°F. The salt solution from all collection receptacles used may be combined to provide the quantity required for the measurements Specified. A laboratory type hydrometer is acceptable for measurement of specific gravity, The pH measurement shall be made electrometrically using a glass electrode with a saturated potassium chloride bridge or by a colorimetric method such as bromothymol blue, provided the results are equivalent to those obtained with the electrometric method. The pH shall be measured when preparing each new batch of solution. The measurement of both sodium chloride and pH shall be made following each test for salt fog chambers in continuous use.

11.1.5 The test chamber and all accessories shall be made of material such as rubber or plastic that will not affect the corrosiveness of the fog. The chamber should be arranged so that no direct impingement of the fog or dripping of the condensate on the test specimen takes place. Liquid which comes in contact with the test specimen shall not be returned to the salt solution reservoir. The chamber shall be properly vented to prevent pressure buildup and allow uniform distribution of salt fog.

11.1.6 Air entering the atomizer shall have a relative humidity of 85 percent and be free of impurities such as oil and dirt.

11.2 TEST PROCEDURE

11.2.1 The test specimen was visually inspected for corrosion, dirt, and oily film. All unnecessary oily films and dirt particles were removed. No corrosion spots were observed.

11.2.2 The inlet and outlet ports of the test specimen were capped and the specimen was placed in the test chamber.

11.2.3 The test chamber was operated according to the specified operating conditions for a period of 240 hours.

11.2.4 At the end of the 240-hour exposure period, the test specimen was removed from the chamber and allowed to return to ambient conditions.

11.2.5 All salt deposits were removed and the specimen was visually inspected.

11.3 TEST RESULTS

The test specimen showed no deterioration or deformation after the salt fog test.

11.4 TEST DATA

11.4.1 A photograph of the test specimen after the salt fog test is presented in figure 11-1.

11.4.2 Functional test data recorded following the salt fog test are presented in table 11-1.

Tab 4 Functional Test Following the Salt Fog Test

Cycle No.	Applied Seating Torque ft-lb	Inlet Port Pressurized		Outlet Port Pressurized		Breakaway Torque ft-lb		Reseating Torque ft-lb		Running Torque ft-lb			
										To Open		To Close	
		Internal Leakage scim	External Leakage scim	Internal Leakage scim	External Leakage scim	6000 psig	0 psig	6000 psig	0 psig	6000 psig	0 psig	6000 psig	0 psig
1	2.5.	NR	NR	0	0								
	2.5	0	0	NR	NR								
	2.5	NR	NR	NR	NR	1.7	1.5	2.5	1.7	0.8	0.0	1.7	0.0
2	2.5	NR	NR	NR	NR	1.8	1.1	2.9	1.7	0.9	0.0	1.7	0.0
3	2.9	NR	NR	NR	NR	1.7	1.2	2.5	1.7	0.8	0.0	1.6	0.0

NR - Not Required

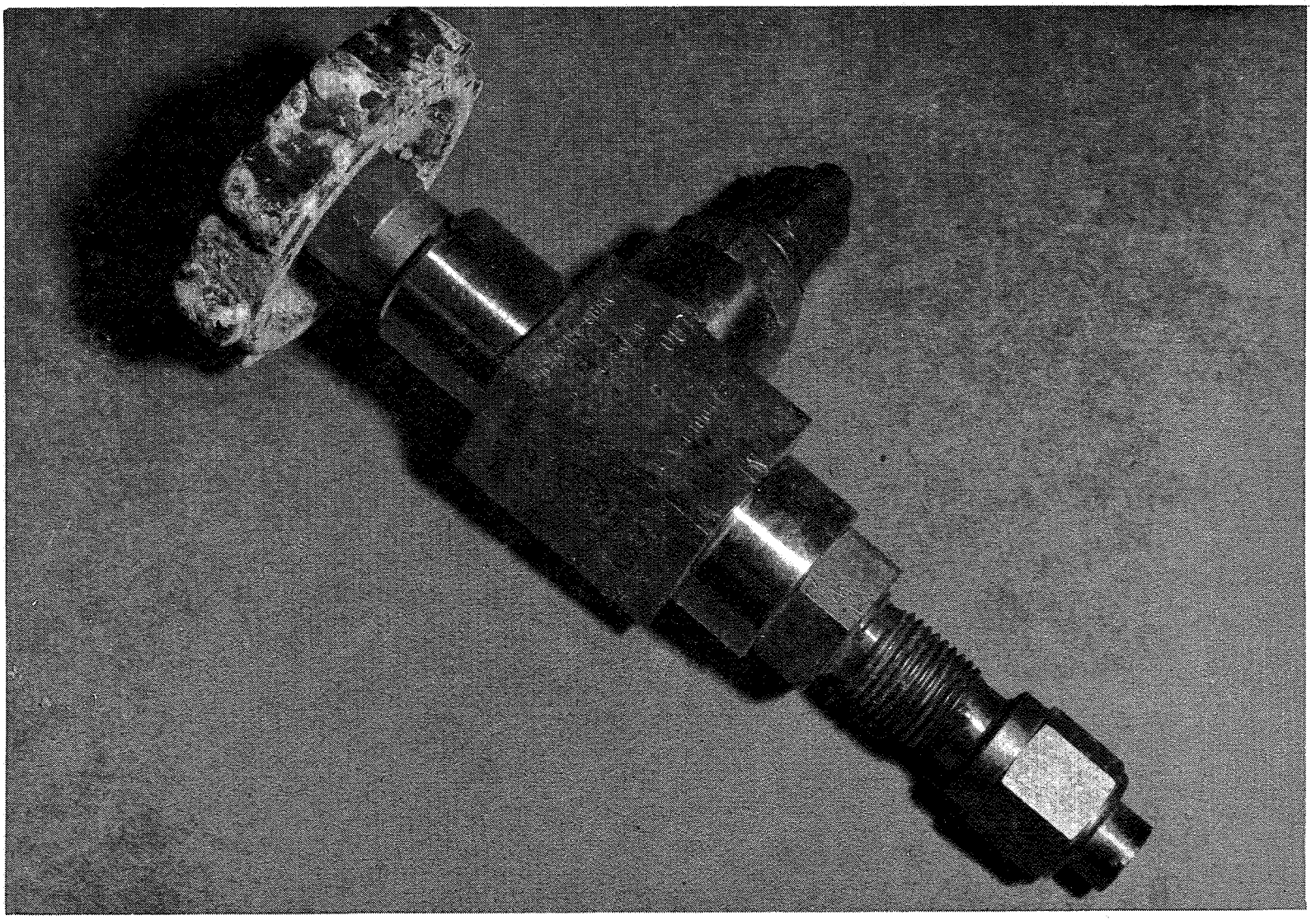


Figure 11-1. Specimen Following 240 h rs of Salt Fog Exposure

SECTION XII

BURST TEST

12.1 TEST REQUIREMENTS

12.1.1 The specimen shall be subjected to a hydrostatic pressure of 24,000 psig to determine the structural integrity of the specimen.

12.1.2 The hydrostatic pressure shall be simultaneously applied to the specimen inlet and outlet ports with the valve in the open and closed positions. The pressure shall be maintained for 5 minutes.

12.2 TEST PROCEDURE

12.2.1 The test setup was assembled as shown in figure 3-1 using the equipment listed in table 3-1. All valves and the specimen were closed.

12.2.2 Regulator 21 was adjusted for zero outlet pressure.

12.2.3 Hand valves 6, 7, 8, 9, 10 and 11 were opened to fill the system with water. The fittings at gage 3 and specimen 1 were cracked as required to bleed trapped air. The fittings were then tightened.

12.2.4 Hand valves 6, 8, 9 and 11 were closed.

12.2.5 Hand valve 5 was opened. Pneumatic source pressure was 3100 psig as indicated on gage 14.

12.2.6 Regulator 21 was adjusted to establish a pressure of 75 psig as read on gage 15.

12.2.7 Switch 17 was closed to open solenoid valve 18. Pump 19 began operating.

12.2.8 Pumping was continued until specimen pressure as indicated by gage 3 was 24,000 psig. Switch 17 was opened to stop the pump.

12.2.9 The 24,000 psig pressure was maintained for 5 minutes. The specimen was then checked for leakage and distortion.

12.2.10 Hand valves 8 and 11 were opened to vent pressure from the specimen and gage.

12.2.11 The test specimen was opened. Hand valves 8 and 11 were closed.

12.2.12 Steps 12.2.7 through 12.2.10 were repeated.

12.3 TEST RESULTS

The specimen satisfactorily withstood the 24,000 psig minimum burst pressure. It did not leak or show any signs of structural damage.

12.4 TEST DATA

Test data are presented in table 12-1.

Table 2-1. Burst Test Data

Specimen	Ports Pressurized	Minimum Burst Pressure	Applied Pressure	Remarks Remarks
1	Pressurized inlet and outlet port simultaneously with the valve opened and with the valve closed	24,000 psig	24,000 psig	No leakage or distortion

APPENDIX I

Test Report No. M592-7512 No of Pages 2

Report of Test on

MANUAL VALVE

SAND AND DUST TEST

for

CHRYSLER CORPORATION

Associated Testing Laboratories, Inc.

Wayne, New Jersey

Date June 15, 1967

	Prepared	Checked	Approved
By	L. Tabback	F. Kopec	G. Ciccone
Signed	L Tabback	F. Kopec	G Ciccone
Date	6/15/67	6-15-67	6-15-67

Administrative Data

1.0 Purpose of Test:

To subject the submitted Manual Valve to a Sand and Dust Test in accordance with the referenced specification.

2.0 Manufacturer: Chrysler Corporation
Space Division
Michoud Operations
New Orleans, Louisiana

3.0 Manufacturer's Type or Model No.: S/N 60100412

4.0 Drawing, Specification or Exhibit: Specification KSC-STD-164(D) dated Sepetember 12, 1964

5.0 Quantity of Items Tested: One

6.0 Security Classification of Items: Unclassified

7.0 Date Test Completed: May 31, 1967

8.0 Test Conducted By: **Associated Testing Laboratories, Inc.**

9.0 Disposition of Specimens: Returned to Chrysler Corporation

10.0 Abstract:

There was no evidence of deterioration of the Manual Valve as a result of the Sand and Dust Test.

TEST PROCEDURE

The sand and dust test was conducted in accordance with Section 16 of Specification KSC-STD-164(D).

The Valve was placed in a sand and dust test chamber. The chamber temperature was increased to and maintained at +77°F for a period of two hours. At the completion of this two-hour perfod, the chamber temperature was increased to and maintained at +160°F for an additional two-hour period. The chamber temperature was then returned to room ambient temperature.

Throughout the entire sand and dust test, the sand and dust density within the chamber was maintained between 0.1 and 0.5 gram per cubic foot and the sand and dust velocity was maintained between 100 and 500 feet per minute, The sand and dust used in the test was of an angular structure having the characteristics described in Specification KSC-STD-164(D).

At the completion of the sand and dust test, the Valve was removed from the chamber and allowed to cool to room ambient temperature. The accumulated duet was removed from the Valve by wiping and the Valve was then visually examined for evidence of deterioration.

APPARATUS

Sand and Dust Test Chamber, manufactured by Associated Testing Laboratories, Inc. (Manufacturing Division), Model SD-36-LC.

Calibration date: 3-30-67
Calibration due date: 5-30-67

TEST RESULTS

Visual examination of the Valve at the completion of the sand and duet test revealed no evidence of deterioration.

APPROVAL

TEST REPORT

FOR

ANGLE VALVE, 3/8-INCH

James, Pond, and Clark, Inc., Part Number BR949T1-6BB(T9)

NASA Drawing Number 75M09618 PAV-2

SUBMITTED BY:

G. Collins
Test and Evaluation Section

APPROVALS:

R. W. Claunch
Program Supervisor

Claud. C. Gage for:
V. J. Vehko, Director
Engineering Department

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Chrysler Corporation Space Division

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